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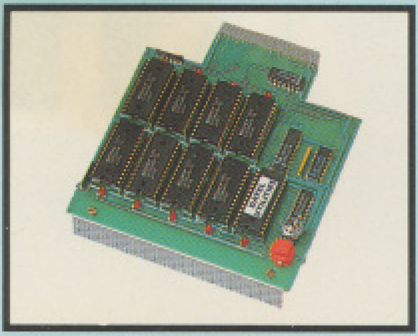
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Mars Saga
Ingrid's Back
Last Ninja II
Emlyn Hughes Soccer

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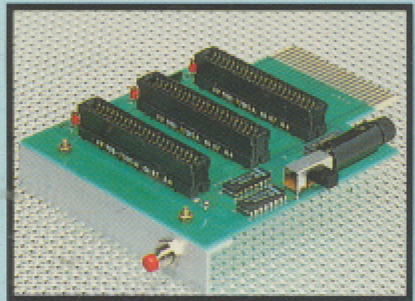
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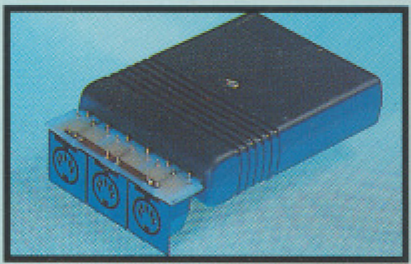


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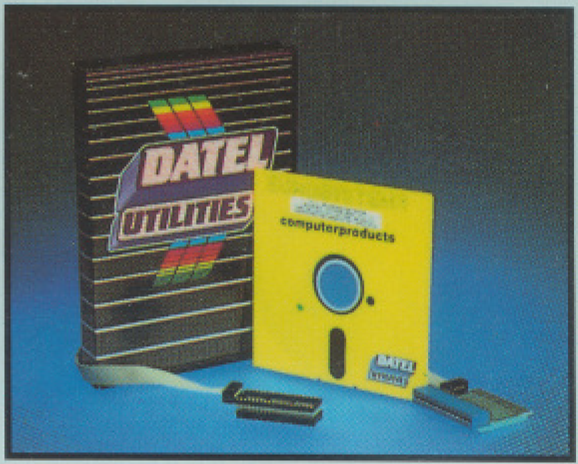
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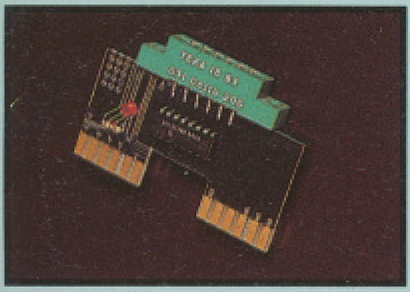
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TURBO ROM II IS A REPLACEMENT FOR THE ACTUAL KERNAL INSIDE YOUR 64. IT PROVIDES SUPERFAST LOAD/SAVE ROUTINES.

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- FLOAD-special I/O loader.
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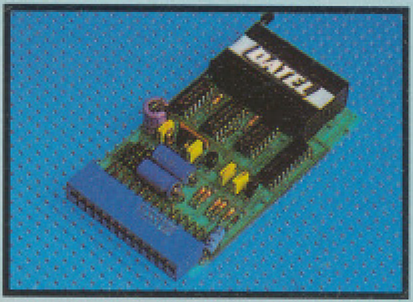
- 32K pseudo ROM.
- Lithium battery lasts up to 5 years.
- Simply load the program you require - then flick the switch. The cartridge can then be removed just like a ROM cartridge.
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- Turn your Smart Cart into a 32K Ram/disk.
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- Train mode allows you to store & then repeat movement sequences.
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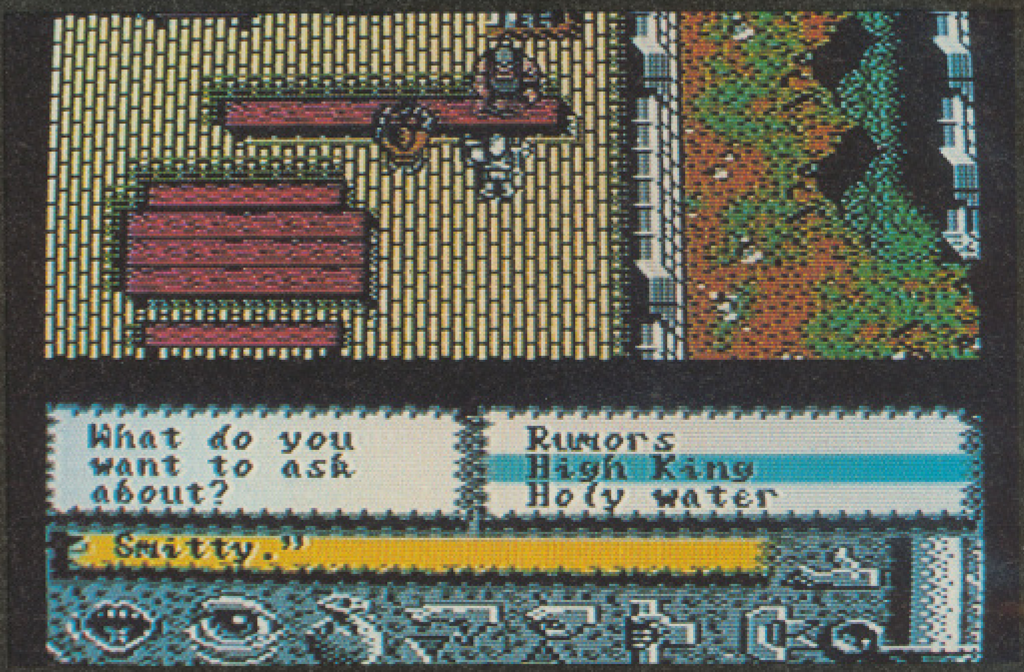
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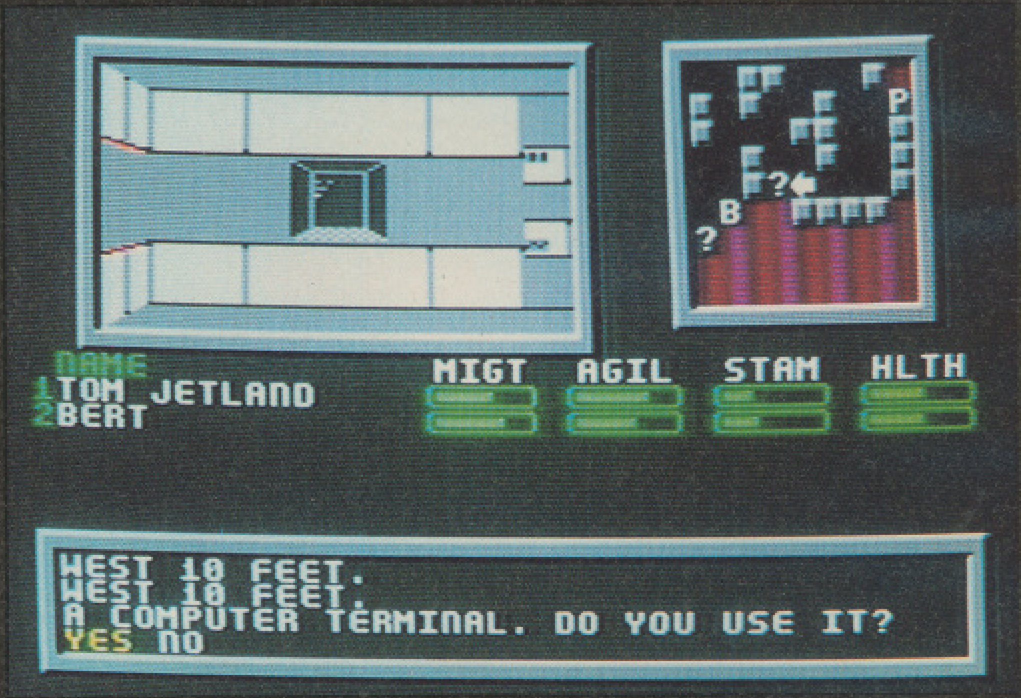
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Mars Saga



Last Ninja II

VOLUME 5
NUMBER 5

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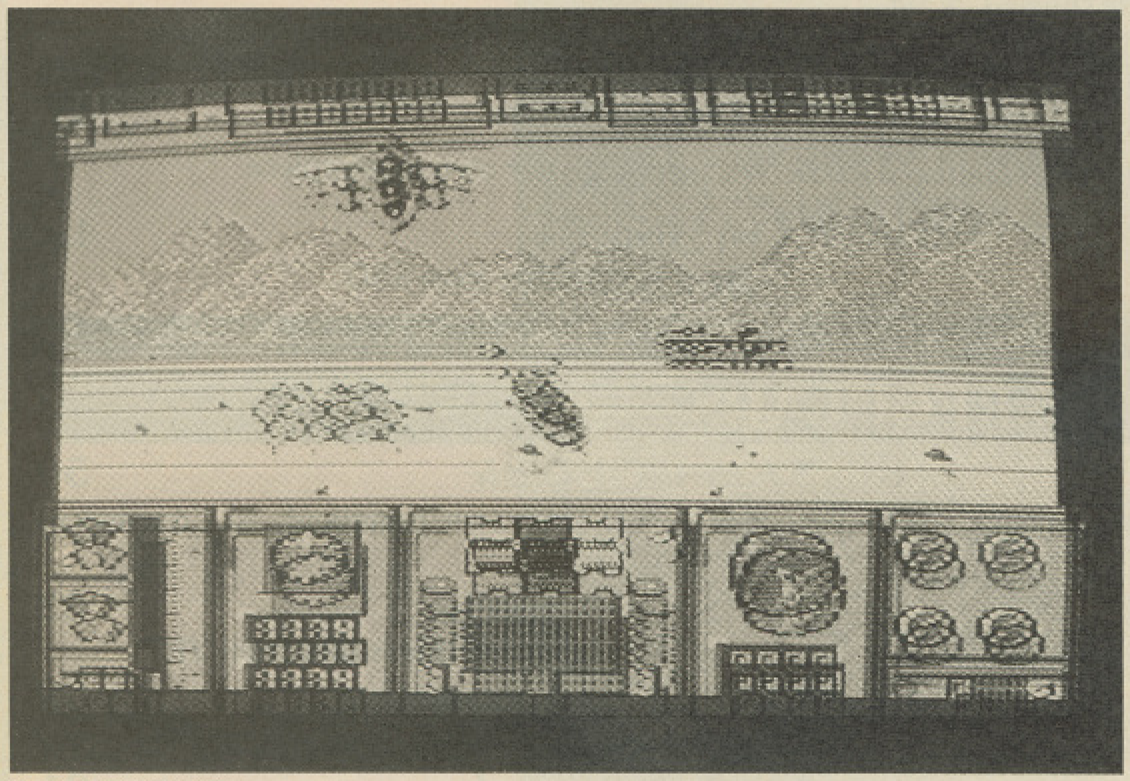
Rambo Returns

Ocean has released the computer version of Stallone's *Rambo III.* Set against a topical background of arms smuggling to Afghanistan's rebels, John Rambo is searching for his captive mentor, Colonel Sam Troutman.

Starting with Rambo's search for the enemy fort where the Colonel is imprisoned, he must then don his rubber gloves to disarm numerous infra-red detector beam circuits while quietly dispatching guards with his knife. The final section involves escaping from the fort with the Colonel and breaking for the border in an enemy tank.

Featuring the massive armoury which Rambo ususally carries around, the game also extensively uses 3D graphics and high-energy action. *Rambo III* costs £9.95 (cass) and £14.94 (disk) for the C64, and £24.95 for the Amiga.

***Touchline:** Ocean Software, 6 Central Street, Manchester M2 5NS.* ***Tel:** 061-980 3488.*



Ocean's Rambo III

Levy Razed

The new Copyright Bill has been approved without the inclusion of the blank tape levy. The larger recording companies have been trying to apply pressure for the inclusion of the levy in an attempt to recoup some of the lost revenue caused by home recording of copyright material such as music and video. Despite strong counter appeals from a pressure group, the Home Taping Rights Campaign, the levy has kept looming around the Bill at all stages of its passage through Parliament.

The problem which led to the omission of the tax lies in the fact that not all tape recording involves copyright material. Organisations such as the Hospital Broadcasting Service and those producing tapes for the visually handicapped were threatened with additional financial hardships.

Although the prospect of increased revenue appealed to the recording industry, the software sector was less welcoming. Before the exclusion of the levy, it looked as though there would be no provision for software houses within the Bill, and this was just one of many reasons for the levy's demise.

The Home Taping Rights Campaign has been battling against the proposed tax since July 1986, just three months after it was proposed in the White Paper on Intellectual Property and Innovation.

On hearing the good news, Campaign Director, David Hall, stated, "The British Government has taken the lead in protecting the consumer and set a lead for other European countries to follow in rejecting this unjust tax."

***Touchline:** Home Taping Rights Campaign Office, Number One, Dean's Yard, Westminster, London SW1P 3NR.* ***Tel:** 01-799 9811.*

Super Sale

Supersoft are giving away £50,000 worth of software to benefit Barnardo's. Supersoft's Peter Calver explains how the scheme will operate. "We have a large supply of surplus software from the last five years, and we want to put it to good use. Anyone who writes in to us enclosing a donation to Barnardo's will receive a program."

The good news is that the software is pricipally for the C64, but donors should state which computer they own, with their name and address. Just in case supplies run out, Supersoft would also like to know if you want your money back should there be no software to send. Please also enclose 42p worth of stamps to cover postage and packing.

All cheques and Postal Orders should be payable to Barnardo's and sent to:
Barnardo's Offer, Winchester House, Canning Road, Wealdstone, Harrow HA3 7SO.

Barnardo's stress that they are no longer merely concerned with providing 'homes' for orphans but are now involved wherever there are young people in trouble or children with handicaps. Funds are always essential to the organisation and David Batterbury, Director of the London and East Anglia Region of Barnardo's says, "We're very grateful to Supersoft. We hope that people will take up this offer and be as generous in their donations as Supersoft have already been."

Court Masters

Sometimes the hot competition for the position of top budget software house bubbles over into legal proceedings. The latest grudge match is between Code Masters and Alternative Software.

The issue is Alternative's re-release of CRL's *Formula One*, renamed *Formula Grand Prix*. Code Masters' claim is that the packaging plagiarises that of their own game, *Grand Prix Simulator*. According to David Darling of Code Masters, "Henceforth we reserve the right to act, without notice, with the full force of the law, against anyone who imitates or copies any copyrighted aspect or feature of our products."

***Touchline:** Code Masters Software, Lower Farm House, Stoneythorpe, Southam, Warks CV33 0DL.* ***Tel:** (0926) 814132.*

DATA STATEMENTS

New Online Service

Commodore PC users amongst our readers who are considering trying out comms, may be interested to know there is a new UK based on-line service in operation.

Called the Direct Connection, it's a subscription-only service which caters for PC users. The software used to run the system has been developed in-house, and is extremely user-friendly. Subscribers can tailor the system to their needs by 'switching' various options such as menus, continous scrolling, default file transfer protocol and so on.

Direct Connection is multi-user, and features a number of conferences. These can be compared with the more conventional 'topics' found on most BBs. However, with conferencing software, the commands to read, scan, search and send items are far more comprehensive.

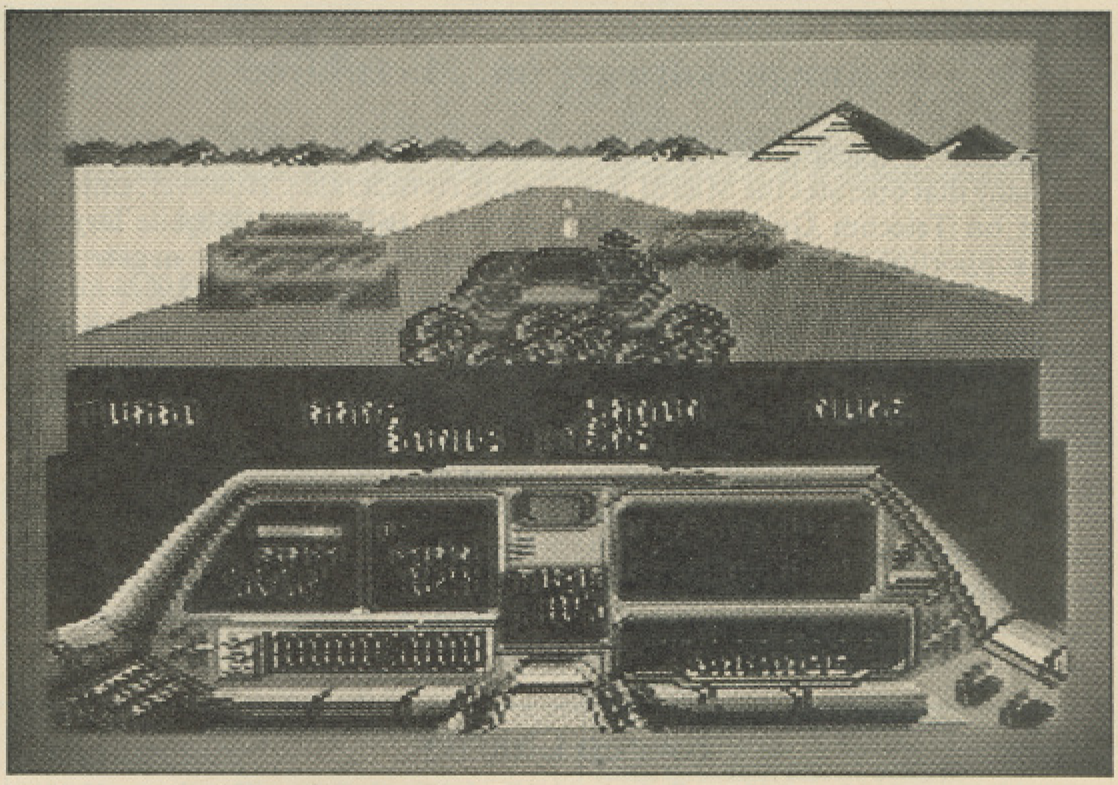
Other features include a daily news bulletin (US origin), and an overnight fax service (text only). To get a better idea of what's available, you can log-on to the Direct Connection with a demo account. Simply dial 01-853 3965 (data), and enter demo at the prompt.

The Direct Connection
MAIN MENU
1 Customer Assistance
2 Electronic Mail and User Directory
3 Communication Services
4 Overnight FAX Service
5 News and Magazines
6 Information Exchanges
7 System Services
8 Demonstration Section (demo users)
9 SIGN UP ONLINE

Smash Hit

Attendance figures for last September's Personal Computer Show have just been published and, yet again, they have broken all previous records. According to an independent survey, there were 99,030 visitors during the four days of the Show. Of these, 71,581 were business and professional visitors and a further 10,498 came from the trade sector.

The dates for the Personal Computer Show 1989 have already been set as September 27 to October 1, and the venue will again be Earls Court.



Technocop, Gremlin Graphics' new release

Thunderbirds are Go!

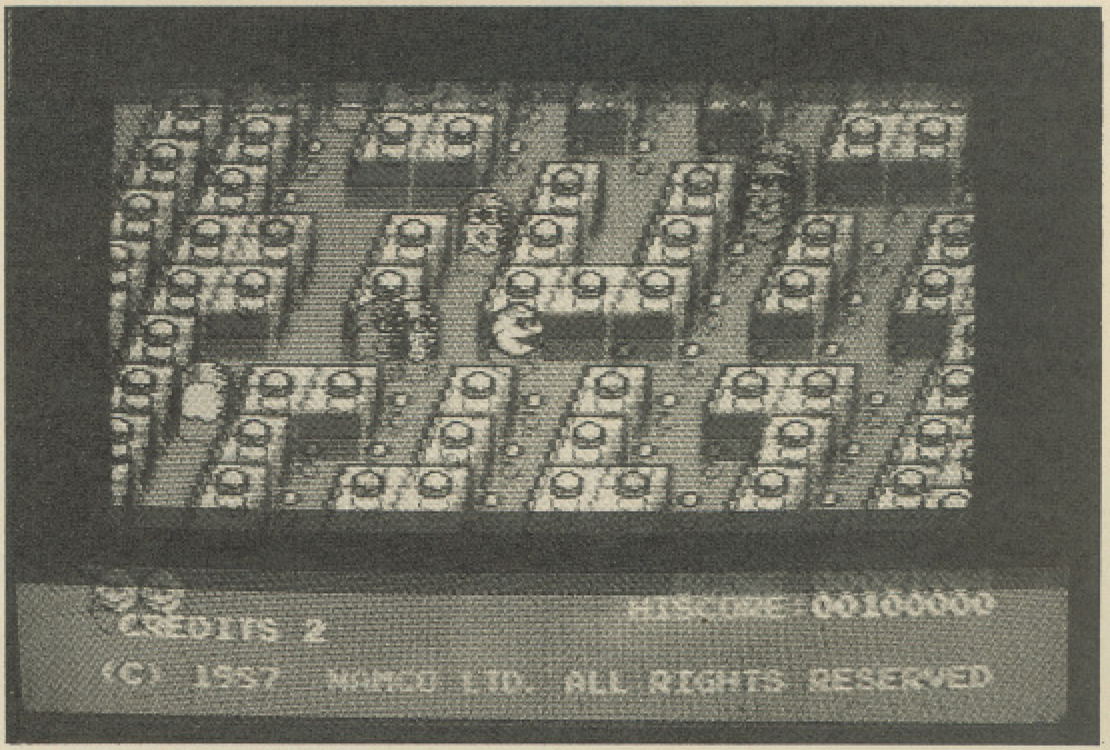
Following on from the recent release of *Pac-Mania*, Grandslam Entertainments have secured the rights to produce the computer versions of Gerry Anderson's *Thunderbirds* TV series and the Arnold Schwarzenegger movie, *The Running Man*.

In *Thunderbirds*, their arch enemy, the Hood, has a video of the Thunderbird machines in operation. The video must be destroyed if the heroic team are to maintain their anonymity, but there are still rescues to be performed while the search for the Hood continues.

The Running Man is set in 2019, where a game show exists for the punishment and execution of criminals. Schwarzenneger's character, Ben Richards, is a fallen law enforcer who refused to open fire on a group of unarmed demonstrators, and his punishment is to be meted out in the horrific dungeons and caves before the eyes of viewing millions.

The caves are inhabited by murderous terminators who revel in names such as Fireball, Dynamo, Buzzsaw and Subzero. The aim is to avoid the sting of their stunning array of weapons and escape, despite the shrieks for blood from the audience.

***Touchline:** Grandslam Entertainments, 12/8 Paul St. London EC2A 4JS. **Tel:** 01-247 6434.*



Pac-Mania – the legend continues

DATA STATEMENTS

Amiga Software on MicroLink?

Database Publications, the company that operates the MicroLink service on Telecom Gold, is considering supporting Amiga telesoftware as part of its service.

Telesoftware on MicroLink is normally provided by the magazines that Database publish, but one factor that might prevent the introduction of Amiga Software is the time it takes to download, according to a spokesman, as Database Amiga files tend to be on the large size, even when ARCed. This would mean that the time taken to download an Amiga item would be quite considerable. However, since PC software (which is also quite large) is supported, this would negate that argument somewhat.

Existing MicroLink subscribers who would like to see the introduction of Amiga telesoftware on the system should mailbox Database on 72:MAG001 and express their opinions. Alternatively, write to Derek Meakin at Database, Europa House, London Road, Adlington Park, Adlington, Macclesfield SK10 4NP.

Sweep Charity

Children in Need could benefit from a charitable bet between Cascade Games and bookmakers, William Hill. The gamble centres around Cascade's horse racing predictor, *Form Master*, for which William Hill's have offered £50 worth of free bets, the proceeds to go to the Charity.

The challenge commenced last November when the first bet was laid by Nigel Stevens, Managing Director of Cascade, and the horse, Beau Ranger, romped home to win the 2pm at Haydock. Commenting on this initial success, Grahame Sharpe of William Hill's stated, "First blood to Nigel but there's still a long way to go. However, most importantly, there is only going to be one winner – Children in Need."

Cascade is obviously extremely pleased with its success and takes a more optimistic view. As Nigel Stevens commented, "We are eagerly looking forward to round two, and we will be keeping everyone informed of the amount raised for Charity."

***Touchline:** Cascade Games, 1-3 Haywra Crescent, Harrogate, N Yorks HG1 5BG. **Tel:** (0423) 525325.*

Y2 News

Amiga owners who use RubyCom and/or RubyView, take note that new 'plus' versions are now available. If you sent off your registration cards when you purchased the packages, you should have received details of the upgrade scheme.

For those of you not in the know, Y2 Computing is renowned as being the top software house when it comes to producing comms software for the Commodore range of computers. The Ruby range of software was specifically written for the Amiga, and the latest versions incorporate a number of enhancements, including the ability to communicate directly with a modem, a better file requester and a facility for storing individual sets of macro keys.

RubyView, the viewdata package, also features an improved cut and paste pixel editor. Y2 Computing are on (0923) 50161.

CBM's Business Machines

Following on from the success of its lower-priced PC1 computer, Commodore has further underlined its commitment to the PC market with the production of a modified version of its existing range. The new machine is simply the PC60/40 with a single drive instead of the 40Mb hard disk.

The new PC60 SD also allows flexibility if the customer wishes to upgrade by allowing the connection of proprietary hard disks or hard cards to suit individual needs and budgets. The substitution of the new drive effectively reduces the cost of the system by at least £1600.

The PC60 SD with monochrome display costs £2399, £2549 with colour display, and the enhanced colour display version retails for £2699.

***Touchline:** CBM (UK), Commodore House, The Switchback, Gardner Road, Maidenhead, Berks SL6 7XA. **Tel:** (0628) 770088.*

FT on Gold

The Xmodem file transfer protocol is about to be implemented on Telecom Gold, and it looks as if MicroLink subscribers will be amongst the first to make use of it.

The Xmodem file transfer protocol is by far the most widely used method of error correction amongst computers today. Up to now there has been no error-corrected method of transfering files to/from Telecom Gold, with the exception of MicroLink users, who have access to the Kermit FTP on request.

Telecom Gold has been experimenting with Xmodem (aka FT) for some time, and it's understood tests have been completed and the facility will be made available any day now.

However, as Xmodem is an 8-bit file transfer protocol, people wishing to use the facility will have to connect to Telecom Gold via the Packet Switched Stream (PSS), as this is also 8-bit, whereas the TG direct dial numbers are only 7-bit.

Besides the obvious advantage of being able to send error-free text to and from the system, binary file transfer will also be possible. Binary files (programs etc) that are sent to Telecom Gold are automatically converted to expanded hex, and can be mailed to another subscriber like any other mail item. When downloading, the reverse happens and the expanded hex file is translated back into binary form.

Supra Modem

The Commodore Computer Show held at the Novotel, Hammersmith, in November was quite sparse on the comms front. Even Y2 Computing, who are regular exhibitors at the show, didn't make an appearance. However, one item that caught my eye was the SupraModem 24000, which is being sold by Frontier Software.

At £199.95, the modem operates at three speeds – 300/300 (V21), 1200/1200 (V22) and 2400/2400 (V22bis) at European CCITT standards. This Hayes-compatible modem also features auto-answer/dial (tone or pulse) and a speaker, which is used to monitor the status of the line.

A free CompuServe (US on-line database) starter kit is also thrown in. Frontier Software are on (0423) 67140/530577.

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- **FULLY INTEGRATED OPERATION.** The MK V 'Professional' has an onboard custom LSI LOGIC PROCESSING CHIP that integrates the whole range of utilities and makes them available at the press of a button at any time.
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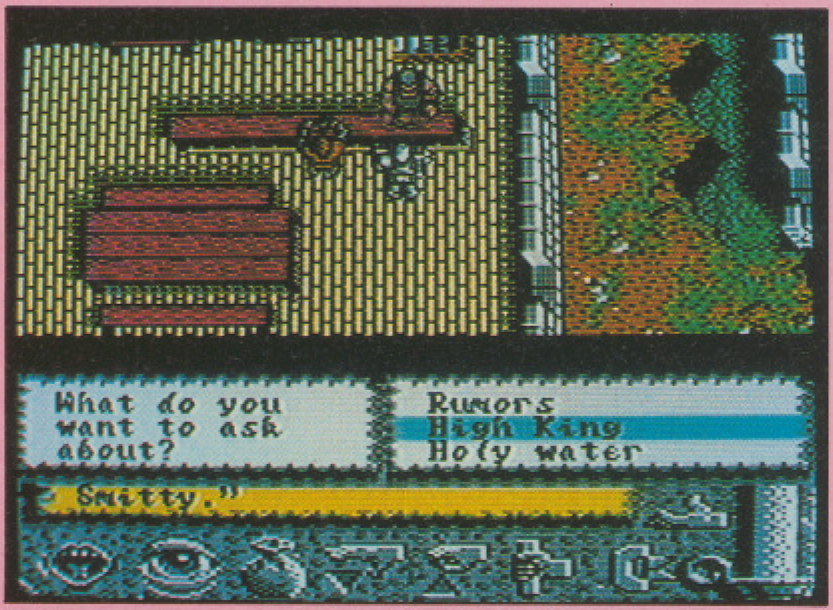
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Times of Lore



The quest is on to find a game that recreates the depth and magic of a role-playing game, yet will be played and enjoyed by the masses of arcade game players. *Times of Lore* is the latest attempt by those adventurers at Origins who created the *Ultima* series of games (see *Ultima V* in this issue) and is also the company's first cassette-based game.

The game covers the times when chaos ruled the land of Albareth. The High King, drained and weary in battle, hides in the Elden routes to recuperate, leaving the land in the control of his steward Dariel, who is weak and unable to stop the many squabbles for power. To make things worse, orcs begin invading from the north. You play a brave young adventurer, and cast your role by selecting from three heroes during an illustrated opening sequence. You can be a knight in protective armour, a barbarian who can deliver a mighty blow, or a valkerie whose abilities are halfway in between.

You begin your destiny in an inn in the town of Eralan, but are soon put to task by a strange woman known as the Prior, who sends you to find the magical foretelling stones – just one of the three magical items used by the old High King to maintain order in the land. This first quest takes you into the forest to the North and into battle with rogues, skeletons, and orcs, who hold the stones in their camp deep in the woods. Should you complete this task, many others lie in wait in this troubled land.

Although the top-down view of the main display will remind you of games such as *Gauntlet* and *Dandy*, this is nothing like them, and if you adopt that slay-everything style of play, your games will end quickly. Instead, you should play it like a role-playing game, noting down clues, carrying out quests, asking friends for information and battling bravely with foes.

Below the main display, a scroll-like text window displays the messages from the other characters in the game, and below that are a series of icons activated by pressing the space bar and selected with the joystick. Through these icons you can talk to the serfs, guards and barons, examine objects, cast a spell from a scroll, drink a potion, load a saved game or pause the game to offer an object to another character.

Despite the fact that you can do all those things, you don't have to type in a single word as everything is joystick controlled. When you talk to a game character – usually an innkeeper as they have more to say – you can inquire about rumours in general or specific objects, people or mysterious happenings. For example, if you asked an innkeeper if he'd heard any rumours, he might say that there have been strange noises as a subject to ask about. Ask again and the innkeeper may give information containing more of these keywords, say he knows nothing, or tell you of someone who may know more. It's then up to you to decide which leads to follow.

Sooner, rather than later, this will lead you into combat with a monster, which is decided with simple joystick presses. Against most monsters, two or three hits should do the job – however, some may take more. They're usually unarmed, but you may find some have weapons, such as a throwing dagger or a bow. Your strength is depicted as a candle, which burns down as you move, and when you're hit in combat, but it can be replenished by sleeping it off in an inn, or drinking a magic potion that you find on a defeated foe.

I've been playing *Times of Lore* for several hours now, so it's just as well that you can save the game (by sleeping in an inn), as there are between 200-300 hours exploring left to go. I have now travelled the length of the land, and have a stack of rumours to chase and quests to fulfil. Apparently there are 13,000 different screen locations to explore, so really I've only just scratched the surface, but I'm hooked already. Time will tell how many arcade gamers are enticed by the game, but it's sure to appeal to role-players like myself. **T.H.**

Touchline:

Title: *Times of Lore.* ***Supplier:*** *Origins (Microprose), 2 Market Place, Tetbury, Glos., GL8 8DA. TEL 0666-54326.* ***Price:*** *£14.95 (disk), £9.95 (cass).*

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The Commodore 1764 RAM Expansion Unit adds 256K of storage capacity to the 64, four times the internal RAM, and comes with a replacement power supply to power both the computer and unit. RAMDOS software is supplied free to allow commercial programs, written for the unit to use it as a second, lightning speed drive. The 1764 Unit is ideal for programmers, GEOS users and users who need a second drive. **Only £99.95**

▷ Paper Clip Publisher
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If you'd like to create eye-catching layouts, but don't enjoy playing with scissors and glue, Paper Clip Publisher has the solution. This powerful page layout program for the Commodore 64 lets you combine text from your favourite word processor and graphics from your favourite drawing program to create almost any layout you can think up.

To place an article into your layout, simply draw a box and pour in the text. Or draw several boxes and link them together, so the article is in several columns, or even on several pages. If you want the text to stand out, choose one of five fonts in any of four sizes. Then, give it some style—you can make it bold, italic, outlined, shadowed, reversed, or even upside down! Graphics are always a great way to get a readers attention PaperClip Publisher lets you use clip art from Doodle, Newsroom, Print Shop, Printmaster, and Stop Press. You can also create simple graphics in PaperClip Publisher's Graphics Editor. Once you've selected a graphic, simply pour it into your layout, then enlarge or reduce it to fit your specific needs.

PaperClip Publisher is a powerful layout tool but, more important, it is also easy to use. Your tools are displayed right on your screen—you simply point and click with your joystick or mouse. Other powerful commands are available in pull-down menus, so you don't have to go searching through your manual to find a command. Whether you are creating a single-page advertisement or a multiple-page newsletter, PaperClip Publisher will help you get the job done quickly and professionally. **Only £34.95.**

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▷ Photo Finish
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This is a NLQ program, Near Laser Quality. On your dot matrix printer you can printout graphics with quality approaching that of a laser printer. It uses an optimizer which automatically computes the amount of available space between diagonal pixels and fills them in with additional pixels, before it prints out your picture. As a result your picture is drawn with smooth curves and diagonals rather than jagged edges. You can take almost any Hi-res picture and produce 640×400 resolution on almost any dot-matrix printer. This program is easily tested, print a picture and look at the curves made up of triangles, Photo Finish would round those edges. **Only £24.95.**

▷ 64 PRODUCTS ▷

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All purpose utility program for the 64. Super Aide hides in memory in a safe, out of the way place, yet is immediately accessible at all times. Super Aide provides, Bi-directional screen scrolling, auto line numbering, line deletion, renumber, trace, a monitor, disassembler, disk directory, display a file to screen, change this to that, find, unnew and more. **Only £12.95.**

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▷ 1541 Repair and Maintenance Guide
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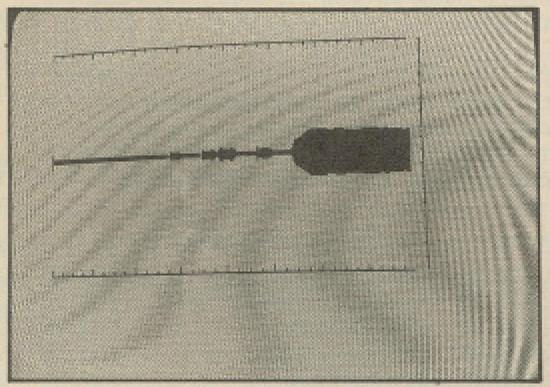
Can Datel turn your study into a studio?

By Kevin Crosby

Sound

There are a lot of things for which computers can be exceptionally useful. Music is one of those things, particularly when delving into the world of MIDI. Today's computer-based sequencer packages are a standard feature in most professional studios and are responsible for much of what we hear in the charts.

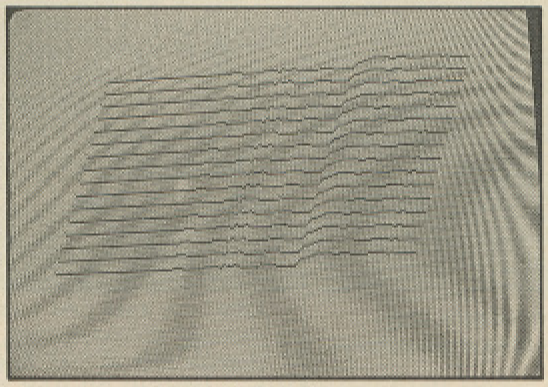
Datel Electronics have taken this theory one stage further by attempting to replace two pieces of hi-tech music hardware with disk-based equivalents, namely the drum machine and the sampler. So can the humble C64 replace Linn Drums and Fairlights? Well, sort of.



Sound Sampler – linear display

Datel's Digital Sound Sampler comes as a hardware unit, which plugs into the user port, and a disk or tape containing all the utilities required to drive it.

The hardware unit has four points of interest on the back. Firstly, there are the two input sockets. No, the unit isn't stereo, one is a microphone socket and the other is a line input. The next socket is a line output suitable for hooking up to a hi-fi amplifier or a tape deck. Alternatively, you can use



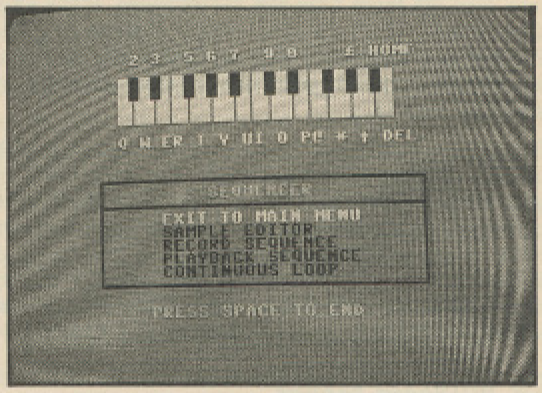
Sound Sampler – 3D display

the lead provided to connect the line output of the sampler to the audio/video socket of the C64. In this way you can hear the sound of the sampler through your TV. Users of monitors will need a jack-to-phono lead to do the same trick. This is stressed as a practice measure in the manual and they advise hookup to an amp for the best results. All three sockets are for standard jack plugs, which is a common enough practice in musical circles.

The final rear-mounted facility is a rotary control knob which is used to vary echo feedback which I shall explain later.

On loading up the software, the screen displays a set of menu options in a basic but adequate manner. First you'll need the set-up menu which allows you to select the sample frequency, the amount of echo you want to add (if any), the recording trigger level and MIDI switch which allows you to trigger the sampler from a MIDI instrument with the aid of the Datel MIDI interface which plugs into the cartridge port.

Datel obviously don't like to own up to what the sample frequencies actually are because they are specified by values between one and eight (one giving you one second of sample time, eight giving you nearly three seconds worth). The actual sampler audio bandwidth seems to be around 10Khz which is about the same as cheap audio tape. There is also an awful lot of background noise even when I hooked the unit up to a decent amp and used studio quality headphones. Not terribly impressive but you can't really expect too much from a £50 piece of hardware.

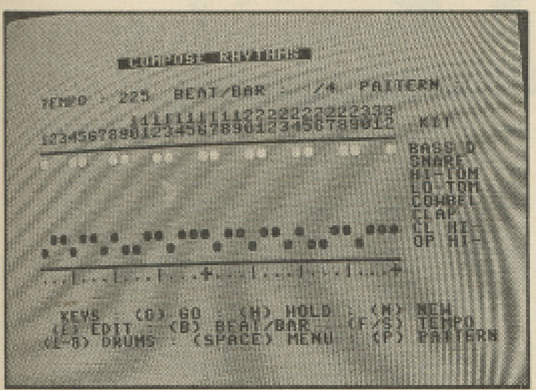


Sound Sampler – Keyboard

On the plus side you can reverse and edit samples once they are stored in memory and the overdub facility allows you to overlay one sample on another. Furthermore, you can use the sampler as a basic real-time echo unit which is fun but, again, not really usable for actual musical applications.

In short, this is a nice toy and a good introduction to the world of sampling but serious computer musicians should forget this as a cheap alternative to a proper piece of dedicated hardware.

Investments?



Com-Drum – Composing screen

Hit that perfect beat

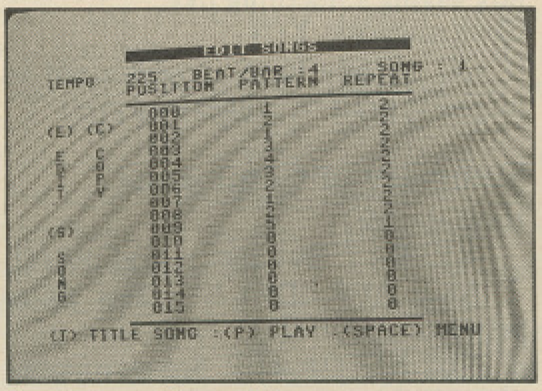
Using similar technology, but to different effect, there's Datel's Com-Drum which, as the title suggests, is a desk-top beatbox. Once again we have a combination of disk or tape software with a plug-in unit that looks almost identical to the Datel sampler. Not so many ins and outs on this one though, just a line level output and a trigger output which allows a crude form of interfacing with proper drum machines or older CV/Gate style synths such as the Roland SH-101.

In its favour, Com-Drum allows you to load in and save drum patterns and drum sounds, so a comprehensive library of different kits can be collected. Presumably Datel will spot the potential market for 'best of' drum machine disks.

Of course, you're not just limited to straight drum sounds. If you have the sampler as well (which seems to be expected of you as both products share one owners' manual) you can port samples across. Your drum patterns could contain vocal snatches, orchestral stabs, excited donkeys, anything. In fact the combination of both products could be marketed as the Hip-Hop Construction Set (no charge for the idea fellas!).

All well and good so far but here's where a few snags crop up. Most importantly, the sound quality was not too hot, although some sounds were better than others, so it could be that Com-Drum is best used for a limited range of sounds. It could also just be down to personal taste, I suppose.

There was also the problem of background noise which, although tolerable when fed through the TV, became very annoying when put



Com-Drum – Song editor

through my studio amp. The only way around this would be to buy some form of noise gate which cuts the sound when the signal drops below a certain level. A cheap foot pedal model will cost between £30 and £60.

Programming Com-Drum couldn't be simpler. You have the option of real-time or step-time recording. I found the best way to enter patterns was to record in real-time and correct errors and add fiddly bits in step-time.

Although you can have up to eight sounds to a kit, you can only have three of them playing on the same beat, which could actually be quite a serious limitation because even the most basic of disco drum patterns will have at least a bass drum, snare and hi-hat on the same beat which means that any tom fill that goes over those particular beats will be lost.

Once you're happy with a few patterns, you can arrange the patterns into songs. It's possible to arrange a standard pop song using five patterns; intro, verse, chorus, middle eight and outro. These can be used once or looped a number of time,s whichever is required.

As with the sampler, Datel seem to hate using standards which give anything away. With Com-Drum the tempo is not measured in BPM (Beats Per Minute) but in some nondescript set of numbers. The equivalent of 120 BPM seems to lie somewhere in the early 200s.

To me, this is also a nice toy but will no doubt lose its appeal if the user starts to take music more seriously. Having said that, the combination of the sampler hardware/software and the Com-Drum software (which Datel will sell separately) may well do a lot of good introducing newcomers to the world of music.

Touchline:
Products: *Digital Sound Sampler, Com-Drum.* ***Supplier:*** *Datel Electronics Ltd, Fenton Industrial Estate, Govan Road, Fenton, Stoke-on-Trent.* ***Tel:*** *(0782) 744707.* ***Machine:*** *C64/128.* ***Prices:*** *Sampler £49.99, Com-Drum £29.99.*
Com-Drum Software (for Sampler) £9.99.

SONIC FX

By Tim Walls

Sound on the 64 is far from easy, and many first-time users can find it a daunting task just to get the simplest sounds out of the machine. This program will hopefully change that. It will let you make some quite impressive sound effects with the minimum of effort and, when you have created the effect, will automatically convert it into a short Basic program.

HEAR SOUND: Will allow you to hear your sound.

DESIGN SOUND:

SET FREQ: Sets frequency for sound.

SET ADSR: Sets Attack, Decay, Sustain and Release.

SET VOL: Sets volume of sound.

SET WAVE: Sets waveform of sound.

SET PULSE: Sets pulse width (pulse wave only.)

Output Sound.

SCREEN DETAILS: Will display all details of sound.

PRINTER DETAILS: Will print details of sound.

SAVE FRAME: Will save frame to tape.

LOAD FRAME: Will load frame from tape.

Getting it in

The program is in Basic. Please refer to our Listings pages before typing it in.

IMPORTANT: After running the program always use option four of the main menu first.

Put SID to work with this powerful sound effect designer

Running it

When you use the program, the first thing that you will see will be a small box saying something like:

Clear memory, Y/N

If you already have some sounds in memory, press 'N', otherwise press 'Y'.

Summary of Commands

Hear sound:

REPEAT: Switches repeat on/off.

SET REP. DELAY: Sets times between repetitions.

SET NO. OF REP. S: Sets number of repetitions.

Incorporating sounds

To convert a sound to Basic, choose CREATE BASIC from the main menu.

To incorporate a sound into your own program you can use one of two methods, depending on how many sounds there are.

METHOD 1 (for one sound only)

* Clear the screen and list your sound.
* Enter NEW.
* Position the cursor at the top of the sound program.
* Press RETURN, continue pressing until all the lines have been re-entered.
* Now use the merge routine supplied.

METHOD 2(for more than one sound)

Type in the following listing:

```
60000 rem *block delete*
60010 f=1:t=9820:s=1:print$(147)
60020 PRINTCHR$(19)F:F=F+S:
PRINT"60040 F="F":T="T":S="S
PRINT"GOTO 60040"
60030 POKE 631,19:POKE632,13:
POKE633,13:POKE634,13:POKE198,4:END
60040 F= 00 :T=00 :S= 00
60050 IF F   T THEN PRINTCHR$
(147):END
60060 GOTO60020
```

Now type RUN 60000(RETURN) The program will now delete itself, but this is very slow, so leave it overnight or something.

Merge routine

To merge two programs together follow these instructions.

* Save the sound programs.
* Load the main program to be merged.
* Enter the following:

```
POKE251,PEEK(43):POKE252,PEEK(44)
  A=PEEK(45)+PEEK(46)*256-2
  H=INT(1/256): L=A-256*H
  POKED43,l:Poke44,h
```

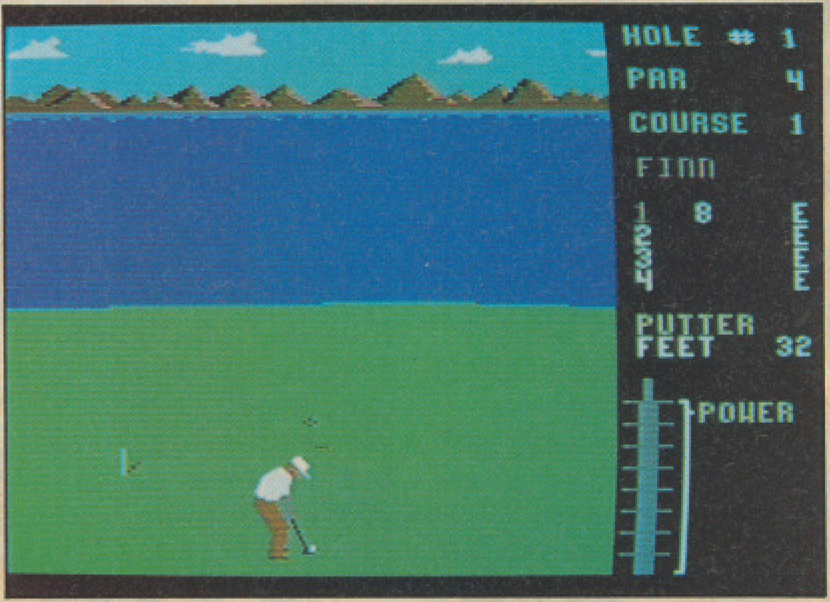
* Now load the sounds.
* Enter the following:

```
  POKE 43, PEEK(251):POKE44,
  PEEK(252)
```

The programs are now merged and ready to be saved to tape or disk.

To use a sound in this state just GOSUB the appropriate line number.

Games Update



Blip — Video Collection

How many people can remember the old black-and-white pong games that were available for TVs a number of year ago? Well if you can remember that far back (I can – Ed), you'll no doubt remember the extremely crude graphics and very poor sound that accompanied what was a very popular game.

You may think that this type of game is a thing of the past – but Silverbird have other ideas: they've just unleashed the horrors of pong on an unsuspecting budget-buying public.

Blip offers the games player a chance to try their hand at any one of six games, each one of them a variation on pong. Some of the games will be familiar to those whose memories expand as far back at the pong consoles, others will be totally new. Pong is the original game. With one bat on either side of the screen, the idea is to knock the ball at your opponent and hope that they miss it, giving you the points.

Colour and sound have been added to this and all other games in the collection, and the addition of a one player-vs-computer-option widens the appeal. Football gives each player control over two bats. One bat moves up and down the edge of the screen as with pong, while the other one has the added ability of being able to move across the screen as far as what would be the centre line.

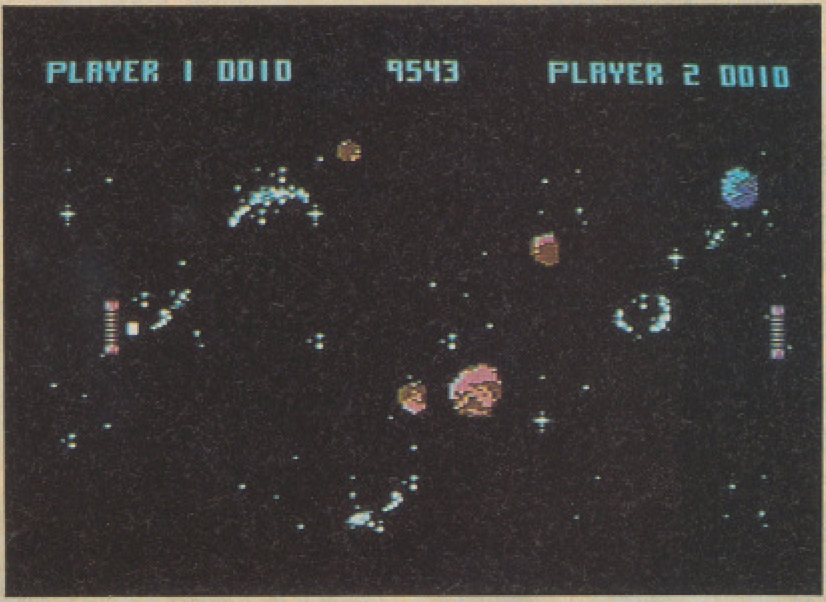
In *Squash* sees, both bats are on one side of the screen, the idea being to bounce the ball off of any of the three on-screen walls, and hope that your opponent misses it as it moves towards the screen edge. *Solo Squash* is practically the same but, with only one bat – more of a practice mode than a game.

Four Bat Blip was a totally new one on me. One player has control of bats at the left and top of the screen, the other has bats at the right and bottom. The idea of the game is to prevent the ball from going off of any screen area that your bats protect. This is probably the hardest game to master.

The final game in the collection is *Asterbliperoids*. Despite it's fancy name, this is just another version of pong, with a number of objects, asteroids, moving up and down the centre of the screen. If the ball hits one of these objects then it could bounce off at any angle – even back to the person who had just hit it.

I must admit that of all the games that I had the chance to look at for this issue, this is the one that I enjoyed the most. Perhaps this is due to a little bit of nostalgia, but it is more likely due to the fact that pong and its variations are great fun to play.

Touchline:
Title: *Blip – Video Classics.* ***Supplier:*** *Silverbird, 1st Floor, 64-76 New Oxford Street, London, WC1A 1PS.* ***Tel:*** *01-379 6755.* ***Price:*** *£1.99.*



Leaderboard

How many times can a game be redesigned and repackaged before people stop buying it? *Leaderboard*, which originally appeared in the UK on an Access/UK Gold Label, proved so popular that various improved versions were launched. *Leaderboard* itself has been available in various packages since its original launch. Now at long last, it's made its way onto a budget label.

Leaderboard offers any games player quite a challenge. On your way around the course you will have to choose you club, allow for any wind that may blow your ball of course and compensate for any slop on the putting green – if you ever get to one!

Even though I'm not a golf fan, and I've got no idea which club does what, I've always found *Leaderboard* an extremely entertaining game. Now that it's available at a budget price from Kixx, you have no excuse for not having this excellent game in your collection.

Touchline:
Title: *Leaderboard* ***Supplier:*** *Kixx, Swan Chambers, Mill Street, Congleton, Cheshire, CW12 1AB.* ***Tel:*** *(0260) 299023.* ***Price:*** *£2.99.*

Game Set And Match

The pre and post-Christmas games markets are always flooded with various compilation packages, and this year is no exception. However, if you're a sports fan, the *Game Set And Match 2* will stand out from the crowd.

The package consists of 10 different sporting games, many of excellent quality – indeed some have held quite high positions in the software charts as full price games.

The games offered in the package are: *Winter Olympiad; Championship Sprint; Track and Field; Steve Davies Snooker; Super Hang On; Superbowl; Match Day II; Ian Botham's Test Match; Nick Faldo Plays The Open* and *Basket Master.*

Game Set and Match 2 offers an excellent family collection, there will no doubt be a game in the pack that will suit every member of your clan. A great collection to spend those dark winter nights with.

Touchline:
***Title:** Game Set And Match II.* ***Supplier:** Ocean, 6 Central Street, Manchester, M2 5NS.* ***Tel:** 061-832 6633.* ***Price:** £12.95 (cass).*

Caveman Ugh- Lympics



Just when you thought you'd be spared the Olympics for another four years, Electronic Arts have released *Caveman Ugh-Lympics,* a stone-age version of the modern game, but without any dope testing. Up to six players can compete in six different events – tossing your mate, hitting each other over the bonce with large clubs, racing dinosaurs, making fire, being chased by sabre tooth tigers and vaulting over dinosaurs.

The format is the familiar one of waggling your joystick as fast as possible in the required directions, interspersed with the need to time certain manoeuvres correctly. The graphics are excellent – cartoon quality – but after the initial appeal, your attention is likely to wane quickly.

Touchline:
***Title:** Caveman Ughlympics* ***Suppliers:** Electronic Arts, 11-49 Station Rd., Langley, Berks., SL3 8YN.* ***Tel:** (0753) 49442.* ***Price:** £14.95 (disk).*

Fast Break



It's the Jammers against the Slammers, and it's the fourth quarter. You've already lost your star forward through six personal fouls – it's been that type of game. Now you've got to call the plays to break down the defence and score some baskets, as you're still trailing 68-75.

There have been basketball games before, but only this one from Accolade (via Electronic Arts) combines the arcade action with coaching decisions – timing substitutions, calling offensive and defensive set plays, and so on. It even includes an option to devise your own special play.

The action is played in 3D on a screen that flips from one end of the court to the other, between two teams of three (with a squad of six to pick from). As in most of these arcade sports games, you play one of the players, but can swap control to another by pressing the joystick button, which is also the means of passing the ball. Holding the button and then releasing it gives you a jump and shoot move.

In defence, you must try to steal the ball without charging or fouling your opponent – you can also intercept passes and jump to block a shot. However, this game goes further than just arcade playing, as you can call offensive and defensive plays to try and outsmart a team. These set out defined running and passing patterns for your team to follow, but you can can define your own by plotting four positions for each of your three players. Just call it when you have the ball at the halfway line, and then see how well it works. If it goes wrong, you can always call a time-out to plan another.

Each player is rated for his speed, inside and outside shooting, passing and ball handling skills, and they're all paired off into alternatives for the centre, guard and forward position. It's up to you to plan the strategy and carry it out.

It's a shame that there are only two teams included on the disk, as either will give the novice player a pounding that might just put him off the game for good – you have to practise to stand any chance at all. Perhaps Accolade are planning a team construction disk, a feature just released for *4th and Inches* through which you can build up your own team. Overall, *Fast Break* is one of the best basketball games you can get, but there's still room for improvement.

Touchline:
***Title:** Fast Break.* ***Supplier:** Accolade (Electronic Arts), 11-49 Station Rd., Langley, Berks., SL3 8YN.* ***Tel:** (0753) 49442* ***Price:** £14.95 (disk).*

By Fair Means or Foul?

It's a puzzle as to how Barry McGuigan got himself involved in the pre-launch publicity for this boxing simulation. As the title suggests, *By Fair Means or Foul* is not entirely played by Marquis of Queensberry rules. You would have thought that Baz, who is not particularly noted for dirty play, might have shyed clear of such a slur on his professional reputation. Large cheques can, of course, account for a lot.

Be this as it may, BFMOF may provide some diversion for lovers of contact sport simulations. Besides the usual fair moves: head punch; body blow; upper cut; and duck punch, there is a range of four foul moves: head butt; kneeing; kicking, and the indispensable groin punch. Of course, the latter moves cannot be used if the ref is looking, under pain of disqualification – but the moment his back's turned...

Superior has at least tried to introduce an element of variety into this often stale genre. I think that fans of fair boxing may, however, find it a little below the belt.

Title: *By Fair Means Or Foul.* ***Supplier:*** *Superior Software Ltd, Regent House, Skinner Lane, Leeds LS7 1AX.* ***Tel:*** *(0532) 459453.* ***Price:*** *£9.95 (cass).*



Powerplay

Cassette version of the most highly-rated *Trivial Pursuit* clone, *Powerplay* adopts the unusual viewpoint of seeing the general knowledge quiz as a cosmic battle between the Greek gods. Successful answers mean that the player can move one of their demigod pieces across a multicolour board. The intention is to challenge one of the opponent's pieces and hopefully eliminate them.

Powerplay is an engaging little game, but strictly lightweight, which may be no disadvantage in a budget cassette version. Doubts linger about the size of the question 'database' – this only goes to three levels of difficulty – and some of the questions may have needed a little more research.

Touchline:
Title: *Powerplay.* ***Supplier:*** *Players Software, Calleva Park, Aldermaston, Berks, RG7 4QW.* ***Tel:*** *(07356) 77421.* ***Price:*** *£1.99 (cass).*

Footballer of the Year

This is like a mixture of an Epyx-style *Games* simulation mated with *Football Manager.* The start of the game sees you, at the age of 17, as an aspiring young player with just £500 to your name. The object of the game, of course is to climb the ladder to fame and fortune.

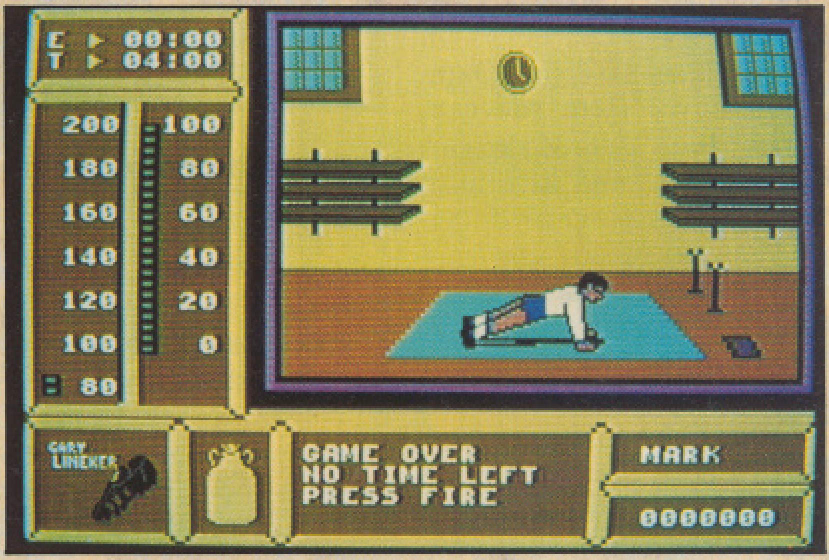
Much of the game consists of financial transactions. You may, for example, buy cards which will be of later advantage. A transfer card may give you the chance to transfer to a more prestigious team, while goal cards give you a lot more chance, in the playing sequence, of scoring goals. Incident cards, which cost £200 each, are random, something beneficial may happen, but it's a bit of a risk.

The arcade sequence pits you against a defended goal, and it's basically an archery shoot. Your goal cards may help you out here.

Footballer of the Year is a very lightweight game and may appeal to younger game players. There wasn't enough in it to hold my interest for long.

Touchline:
Title: *Footballer of The Year.* ***Supplier:*** *Gremlin graphics, 32 Ludgate Hill, Birmingham B3 1EH.* ***Tel:*** *(021) 236 9146.* ***Price:*** *£2.99 (cass).*

Gary Lineker's Superskills



It certainly seems to be the season for football-based games, although software houses are as usual faced with the fundamental fact that computers are better adapted to single-player use, so football in its full glory is a tad difficult to convert convincingly. Gremlin's way of getting around this chestnut is to stress the training aspect.

Superskills puts you through a demanding and exhausting series of gym and field trials and rates you accordingly. In the gym, you are asked to perform push-ups (hardly the most exciting of competitive activities, I would have thought), squat thrusts (yawn!), weight training (picking up a bit) and a work-out on the parallel bars (so-so).

Things get a little more exciting in the field, which requires you to do a fair bit of slalom work (dribbling, chipping and shooting) and also tests your ability to take penalties.

At the end of all this, you get the chance to try for a real goal. Should you achieve this, you can have a go at kicking a ball through the middle of an old tyre. A gusting wind may make this harder than it sounds.

If you're a soccer fan, you may enjoy this.

Touchline:
Title: *Gary Lineker's Superskills.* ***Supplier:*** *Gremlin Graphics, 32 Ludgate Hill, Birmingham B3 1EH.* ***Tel:*** *(021) 236 9146.* ***Price:*** *£9.99 (cass), £14.95 (disk).*

Supersports — The Alternative Olympics

Okay, so we've all had more than our fair share of Track & Field type games, particularly during the summer months of last year. Now it would seem that Gremlin has decided to use a similar format but with different sports.

Supersports consists of five events which can be attempted individually or as a set. First of the five is 'Crack Shot' which is a shooting gallery set in an alley. Various points are awarded for static or moving or thrown targets and points are deducted for shooting alley cats.

Next we have the 'Dare Devil Dive'. Here you can select your desired height (40-400 feet) and dive into a small area of water doing as many tricks as you can to obtain style points while keeping your shadow over the water for accuracy points.

Thirdly we find ourselves amid a 'Slate Smashing' contest. You have one minute to kick and punch your way through as many slates as possible. Mind expanding stuff!

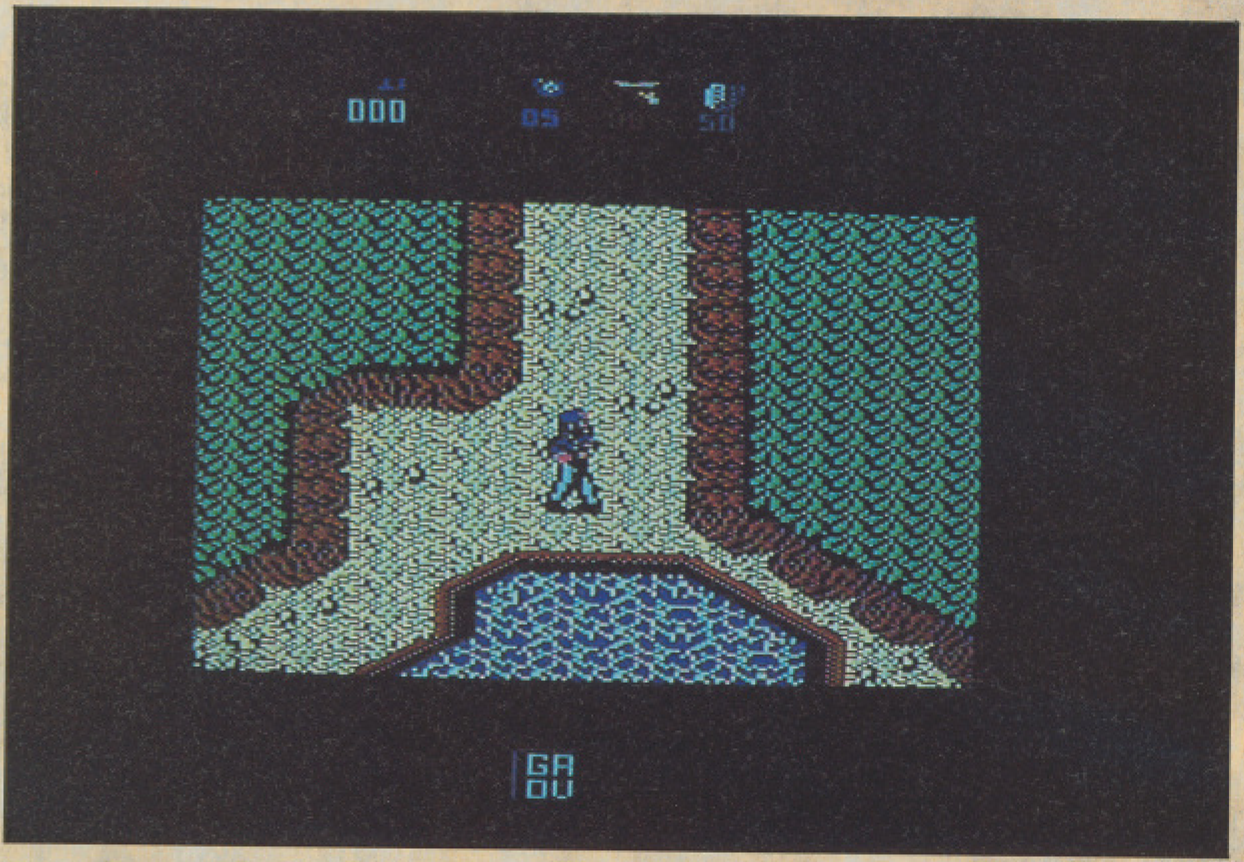
Then there's 'Cross Bow' which, as the name suggests is yet more target practice for budding cider drinkers.

And finally we have the grand 'Underwater Assualt' Course. Yes that's right, the *Krypton Factor* with flippers.

All in all not a bad selection of sport, but I do feel that the novelty will wear off quite quickly.

Touchline:
***Title:** Supersports. **Supplier:** Gremlin Graphics, 32 Ludgate Hill, Birmingham B3 1EH. **Tel:** (021) 236 9146. **Price:** £9.99 (cass), £14.99 (disk).*

Guerrilla War



Yet another *Ikari Warriors/Commando* clone emerges. This one is from software stalwarts Imagine. And once again a software house can truthfully say that this is not a rip-off but officially licensed from an arcade coin-op, this time from a relative unknown manufacturer SNK (Shin Nihon Kikaku) Corp.

Nothing particularly unique in this version apart from the fact that you can rotate your trooper's body left and right while still moving forward. This is achieved by using the X and V keys on the keyboard or by investing in a Cheetah 125 Joystick, although personally I wouldn't buy one purely on the strength of this game.

It certainly isn't the best version around, thanks largely to the Spectrumesque graphics and the sluggish gameplay.

Touchline:
***Title:** Guerilla War. **Supplier:** Imagine Software/Ocean, 6 Central Street, Manchester M2 5NS. **Tel:** (061) 832 6623. **Price:** £8.95 (cass), £12.95 (disk).*

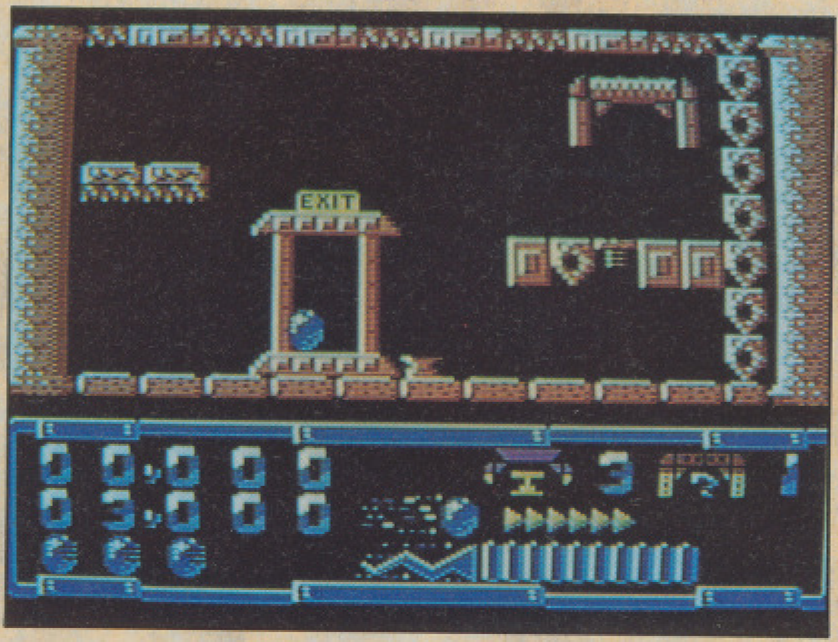
Power Pyramids

There have been many myths surrounding the great Pyramids, Quicksilva (under the Grandslam umbrella) has added one of their own in the form of the game.

In *Power Pyramids* you're a kind of intergalactic Barratt Homes rep who sells pyramids to various planets, in this case Earth.

Before your client takes charge of the pyramid, you have to make sure that all the levels are powered up and fit for use which involves sending a little blue ball round the place switching on the power. Yes you've guessed it, what we have here is a levels and ladders/Jet Set Willy style graphic adventure. what more need I say, 128 screens, pleasant graphics and sound. Good for its type.

Touchline:
***Title:** Power Pyramids. **Supplier:** Grandslam Entertainments, 12/18 Paul St, London EC2A 4JS. **Tel:** 247 6434. **Price:** £8.95 (cass).*



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Tape Menu

Want to know where your cassette are files are stored? This utility takes all the angst out of the process

By I J Brotherston



In those dim dark days when all I had was a computer and cassette, the forerunner of this program was developed. It displays a list of all the programs contained on a tape, in much the same format as a disk directory. It was a little simpler than the present version, but, with tape turbos making storage more efficient, I have extended it considerably.

I use it mainly for storage of backup programs, held on C60 cassettes. I have therefore made allowance for up to 30 programs to be stored.

In its present form the program displays a directory of the programs held on any particular tape, and will automatically fast forward to the start of any program selected. It also provides an autorun facility for Basic programs and will line the tape up ready to save a selected program. Of course it can't do this all on its own. It needs you to put in the trip counter details from your cassette, program number and program name first. These are held in the DATA statements.

Even now that I have a disk drive, I still keep my backup copies on tape, so the program still gets well used. In the interests of speed, it is best used with a tape turbo of some sort, such as the program given in the November 1985 issue of *Your Commodore*.

Tape Menu should be the first program on your tape. It's fairly friendly, but not completely foolproof. It can be customised, and to this end I have included a list of the variables used, and what they do. Once you have filled in the details of your programs, you will, at some time, want to either add, change or delete some details. Once you have made these changes, resave Tape menu over the original. Don't worry, the DATA statements have been padded with spaces so that when you resave, the next program on the tape will not be overwritten.

Once you have your programs saved, and have placed the relevant details into Tape menu, just follow the on-screen instructions. There are just a couple of restrictions. You have to start with a blank tape. You can't just tack the directory onto the beginning of any tape and trust to luck. The timing for the fast forward (lines 440 – 480) is set for my cassette unit, and cassette units do differ slightly in their speeds. Even so the counter readings should be within acceptable limits. If they are not, a little judicious adjustment of the '14.75' in line 480 should do the trick. Increase it if your cassette counter is lower than that held in the program, and decrease it to adjust the other way.

I have found this to be an invaluable utility for about four years now, and I hope you will find it equally useful. You can customise it in various ways, and here are just a few suggestions:

The title of the tape can be changed. This is held in line 50.

In line 40 the variables F and L can be altered to define the total number of entries and number of lines to each page. If you change F, don't forget you also have to change the number of DATA statements as well. Also, if you go over 30 entries, you will need to alter line 650, to increase the number of pages available. You don't however have to worry about the number of lines fitting exactly onto a page. If you don't have a full page it will be padded with blank lines.

You can also change the on screen messages and colours to suit your own taste, or do away with some of them altogether to shorten the program.

Well, there you have it. Here are the list of variables I promised.

Variables used:

P – This tells the program which page you are on.
F – The total number of entries held in the directory.
L – The number of lines per page.
N – The program number used by the program.
N$ – The program name as given in the directory.
S – The trip counter reading at the start of a program.
E – The trip counter reading at the end of a program.
I – This is used to step through 'READ' statements etc.
A$ – The first digit of the program number selected.
B$ – The second digit of program number selected.
Q$,T$,L$— Selects your choices of 'SAVE,LOAD,RUN, etc'
C – For comparison to the computers internal clock.
K – Space taken up on tape by TAPE MENU.
T – For comparison to the computer's internal clock.

Getting it in

The program is 100 per cent Basic code. For help typing it in, refer to our Listings page.

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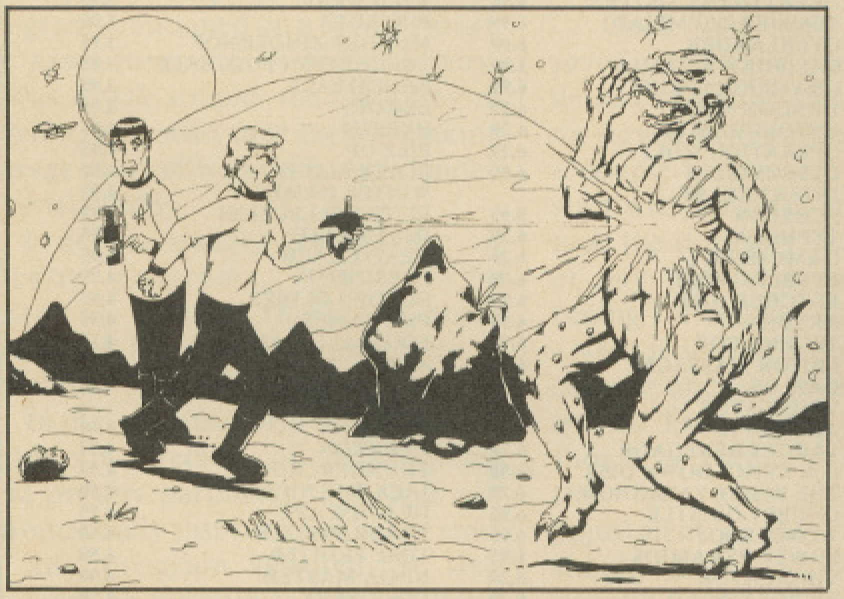
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The autofire switch doesn't operate until the trigger is held, which makes it perfect for most games, and avoids the possibility of overshooting through score tables and menu screens. In short, it's an excellent joystick that's well worth winning!

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Simply study the two cartoons on this page and find the two differences between them. When you think you've found them all, fill in the entry form, and remember to also write the number of differences of the back of the envelope, otherwise you won't be accepted. Send your entry to the address on the form by February 28th, and keep your fingers crossed.

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Entries will not be accepted from employees of Argus Specialist Publications or Konix. This restriction also applies to employees' families and agents of Spectre.

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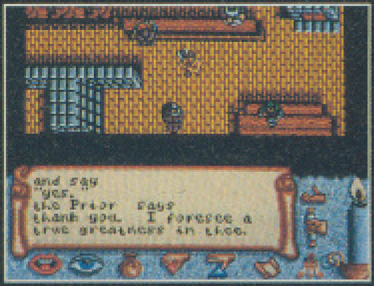


Commodore Amiga



The Knight one of three character classes.

Atari ST



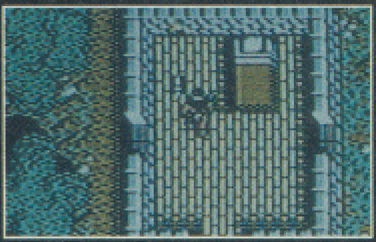
Converse through simple commands and menus.

DISCOVER AN ARCADE ADVENTURE WITH HIDDEN DEPTHS

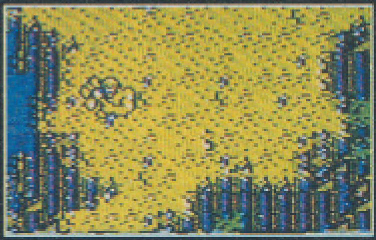
Discover Times Of Lore, Origin's first adventure on cassette. Acclaimed British designer Chris Roberts has taken the best of arcade and adventure – fast and furious combat, stunning graphics and animation, unrelenting danger and challenge – and introduced the depth of a classic fantasy role playing game.

Entirely joystick driven, Times Of Lore continuously tests your combat skills while you gradually become involved in a compelling plot. With 13,000 screen locations, a powerful but easy-to-use menu and icon interface, scores of interactive characters and music by Martin Galway, it ventures further than other arcade adventures.

Origin have broken new ground in Times Of Lore. Isn't it time you did too? Available for: C64/128 Cassette £9.95, Disk £14.95, Spectrum 48/128K Cassette £9.95, Spectrum +3 Disk £14.95, Amstrad 464/6128 Cassette £9.95, Disk £14.95, Atari ST £24.95, IBM/PC & Compatibles £24.95, Apple £19.95, Commodore Amiga £24.95.



C64/128



Spectrum



Amstrad

Journey through an immense world of cities, dungeons, and a stunning variety of natural terrain.

ORIGIN

Origin, MicroProse, 2 Market Place, Tetbury, Glos, GL8 8DA. Tel: 0666 54326

Emlyn Hughes

Here's a game of 90 minutes that will provide end to end action for both human and computer players, and leave you feeling either over-the-moon-Brian or as sick as a parrot.

First reactions from anyone seeing a screenshot of this game will be that *EHIS* is an *International Soccer* clone, but on closer inspection this game goes a lot deeper, with individual player statistics, league and cup competitions and intricate ball control that you must perfect if you're going to win anything.

EHIS isn't the most friendly of programs – the game opens with a blank screen, except for a command bar at the top. Moving the joystick-controlled cursor to the top accesses four menus that allow you to define game options such as: points for a win, minutes in a half, changing screen colours, selecting a team to play, picking the players from the squad who will play, and deciding whether it will be a league or cup competition or just a friendly match. Whatever your choice, you're restricted to eight teams, which is easy enough for a game in which the emphasis is on action, not management.

Once you've made your many decisions, the familiar *International Soccer*-style screen appears, but with a few subtle differences such as advertising boards. Unlike *International Soccer, EHIS* uses all 11 players in a side – each has his own running, tackling, speed and fitness ratings that will affect how he performs on the field. The fitness rating is perhaps most important, as this is reduced for each match played, and particularly heavy tackles that can mean that your star player plays well below his best.

After only a few minutes, you'll begin to appreciate the extra control *EHIS* gives you over the players – instead of the usual press for pass or hold for shoot style, you can set the speed, direction and height of the shot, pass or cross through relatively simple, joystick moves. So, with practice you can pass the ball with pinpoint accuracy across the field, lob crosses into the box and shoot from impossible angles.

When you haven't got the ball, you can either try and intercept passes, block the man with the ball or even slide in for a tackle, but you may end up giving away a free-kick. You also have more control over set pieces such as free-kicks, throw-ins and corners – a press of the fire button will mean the kick or the throw will be towards the player you control at the moment, though you can leave it to the computer to work out the best place.

The action is accompanied by a cheering crowd, and a commentary in the form of a bar at the top of the screen that displays who has the ball, the name of the nearest opposing player, the goal scorers and the direction of free kicks and throw-ins. Unfortunately, this is most distracting, as it flashes just as you're concentrating on threading a pass through the opposing defence. It's not particularly accurate either – I was informed at one point that a player had scored after five minutes, when only four had passed on the game clock in a game with only five-minute halves. If they insist on these interruptions, they should at least be accurate.

Overall, this is a good expansion of the *International Soccer* type of game, but it will disappoint those looking for a full player management game.

T.H

Touchline:
Title: *Emlyn Hughes International Soccer.* ***Supplier:*** *Audiogenic, Winchester House, Canning Road, Harrow, HA3 7SJ.* ***Tel:*** *01-861 1166*
Price: *£12.95 (disk) £9.95 (cass).*



ULTIMA V



Lord British had disappeared! This news will undoubtedly set pulses racing throughout the length and breadth of Britannia, and also cause mounting excitement amongst role-playing fans, for it means the arrival of another *Ultima* game. The *Ultima* games have previously been the standard against which other computer role-playing games (rpgs) have set themselves. As games of this type proliferate, can Origin System maintain its place at the top of the pile?

In Britannia, a whole new underworld has come to light. This appears to be coupled with a strange evil spreading through the land, and it was a possible connection between the two that Lord British was investigating when he was captured. One member of his party managed to escape to inform the land of this massive threat to their wellbeing. With their leader absent, they decide to summon you, an avatar (see *Ultima IV*), back to Britannia. Unlike other rpgs, where your character is decided by random roling of dice, here you have to answer a series of moralistic questions in order to generate your persona for the game.

If you've played any of the other games in the Utima series, the first thing you'll notice is that graphic detail has been enhanced out of all recognition. Rooms now contain furniture which can be pushed and pulled around. Cupboards and desks all have to be searched to see if they will glean an extra clue or yield a potion. There are even harpischords that can be played, including one that transports you to a magical area should you play the correct tune. My one main grumble about the game is that all this searching takes too long, especially when coupled with the snail-like pace of the Commodore's disk drive.

You start the game with two other characters in the party, although you'll soon find others willing to join your cause. Too many in fact, but there is a place where you can drop them off and pick them up again later if circumstances change.

Information is the key to the game. You start off knowing precious little about the task in front of you, and only by talking to the many characters in the game do you start to get some idea of what's going on. Some folk will merely pass the time of day, others will give you direct clues, or refer you to a third person.

There are several mini-quests for you to complete as well as the main one. Make sure that you write everything down – you never know what may or may not prove vital. The characters don't remain static throughout the game – they move about, and go to bed when the sun goes down. Time is an integral part of the game, and you'll find a different sort of person moving round at night than you would during the day.

Ultima has always had one of the better magic systems – most characters have some magical ability in the form of magic points. Spells have to be prepared beforehand by mixing the appropriate reagents, not all of which are readily available from your local apothecary. There are 45 different spells, and I *mean* different, unlike most games, where you get the same spell in half a dozen guises. You'll need to change the wind direction, stop time and summon demons as well as the more mundane curing wounds and removing traps.

Battles are tactical in nature – you can move round and pick your targets as you see fit, providing you have a suitable weapon. Each character moves in turn, and how you organise your party is entirely up to you. Though I'm all in favour of tactical combat, I felt that the system used here didn't work quite as well as that used in the recently released *Dungeons and Dragons.*

The game is huge, and will take many hours to solve (estimated time is 100 – 200 hours) as you explore dungeons and the underworld, towns and castles. Secret doors are plentiful but even so, most of them are locked, and you'll need a key to get through them. Try walking into fires! Sure, you'll get burnt, but there's often something useful hidden behind the fireplace.

This review has barely touched the detail within the game. One area where the *Ultima* series does show its class over its rivals is in the scenario and atmosphere within the story, which is totally credible. Add this game to your collection without delay.

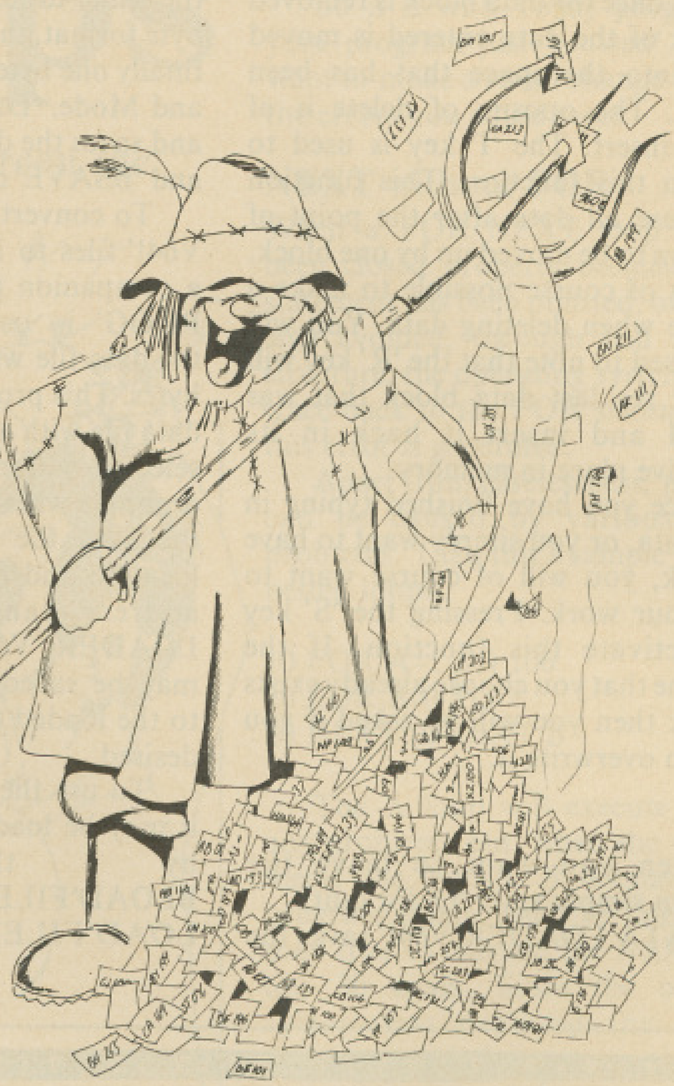
Touchline:
Title: *Ultima V* ***Supplier:*** *Origin/MicroProse, 2 Market Place, Tetbury, Glos. GL8 8DA Tel 0666 54326* ***Price:*** *£19.95*



Data Loader

This handy little utility should make the task of keying in Your Commodore *listings an awful lot easier.*

By D R Murr



We at *Your Commodore* realise how difficult a task it is entering page after page of listings, even though our checksums should have made life easier. This program should make things a little better.

Data Loader lets you enter data bytes, of machine code or whatever, in blocks of any size you choose. So, if you pick our standard DATA line size of 16 bytes, that is also the block size. When you've entered a block, you can then enter the checksum to validate it. The program also includes extensive editing facilities.
Now read on...

Getting it in

Two versions of Data Loader have been provided – one for the C64 and one for the C128. Both are written in Basic. Please refer to our Listings pages to clarify the entry procedure.

Running the program

Since the programs are Basic, simply LOAD and RUN them to get them going. Once you start the program, the program heading will appear and you will be asked if you want to load an existing file into memory. If you don't want to continue entering data into a new file then you will be prompted for the block size (8-16). At this prompt you should enter the number of data items that are on the lines that you wish to enter minus 1 to allow for the checksum that appears at the end of every line in our listings.

Once the block size has been entered you will be asked if you want to enter the data in Hexadecimal or Decimal format. Following a correct response to this, you will be asked for the start address of the data to be entered. It is worth noting that if you are continuing entering data to a program that already exists on disk, the start address, block size, entry mode and the next address will all be displayed as soon as you have loaded in the program.

Once you start entering data you will see that the program keeps you informed of the block number that you are working on and the number of blocks that you have entered. Directly below these you will see the ADDRESS and DATA column labels.

When you are ready to enter a new block type 'E'. You may then enter the relevant data. Characters can be deleted using the DEL key. The program will only allow you to use the keys that are used in your chosen entry mode (ie. 0-9 in Decimal and 0-9 plus A-F in Hex mode).

Each time that you finish entering a line of data, the checksum of that line will be displayed alowing you to compare it with the listing that you are entering.

Should you wish to modify any block that you have entered you can do this by typing 'M'. Use the delete key as normal to allow you to change data items.

Pressing the 'N' and 'P' keys allows you to view the Next and Previous data blocks. The 'G' key allows you to GOTO the data block that you specify. The ESC key in C128 mode and the F1 key in C64 mode act as abort commands returning you to the main menu.

It is possible to delete blocks of data with the 'D' key. This takes some time, as once the data block is removed the rest of the data entered is moved down into the space that has been opened. The oposite of delete is of course insert. The 'I' key is used to perform this function. This function will cause all data after the point of insertion to be moved up by one block.

It is of course possible to make a mistake when deleting data. You will be pleased to note that the 'R' key will recover the last data block that was deleted and insert it back in its respective place in memory.

Once you have finished typing in your data, or you simply want to have a break, you will of course want to save your work. Pressing the 'S' key will activate this function. If the filename that you choose already exists on disk then you will be asked if you want to overwrite it.

When you want to leave the program simply enter 'Q' for quit.

'DATA LOADER V64!' saves the data by first saving the Start Address (as per a normal program file) then the End Address +1 in low byte/high byte format, then the data blocks, then finally one byte which is the Block Size and Mode. 'DATA LOADER!' loads and saves the data using the 'BLOAD' and 'BSAVE' commands.

To convert the 'DATA LOADER V64!' files to a normal program file, a companion program '64 DATA — PROG' is used to load and save the data file without the End Address bytes. This program may also save the data file with a different Start Address selected within the set range. This is desirable where you may want to load the data file into a lower memory location and not be restricted by the address ranges in the 'DATA LOADER V64!' program. The file may be saved with a '&' sign added to the loaded file name or changed as desired.

To use the data file in a program it may be loaded within the program by the command BLOAD'FILENAME' (for 128) or LOAD'FILENAME',8,1 (for 64). Don't forget to include a flag in your 64 program when using the 'LOAD' command.

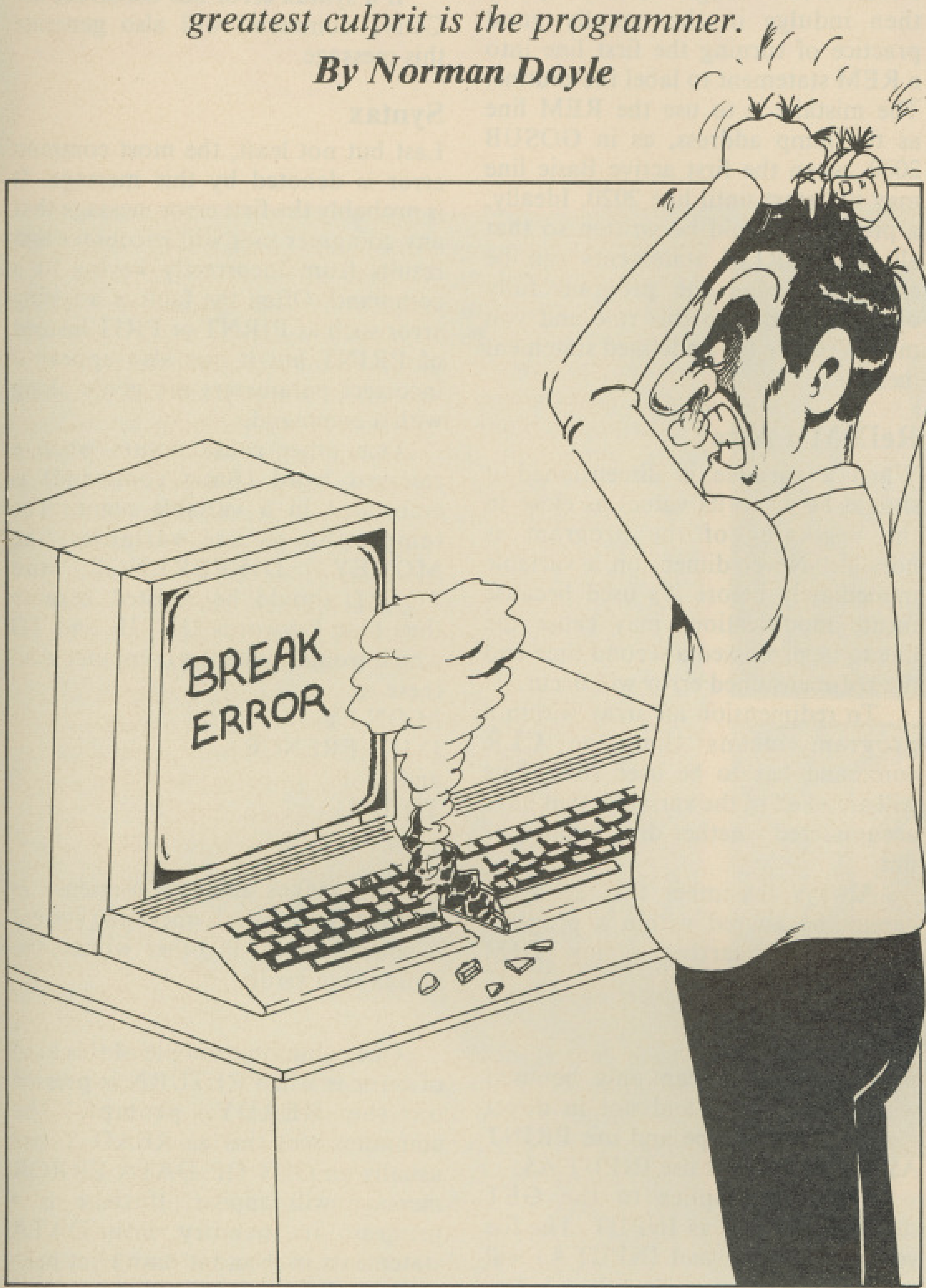
That's it! As you can see the programs above will be an indispensible tool for those programmers who don't want to type in a large number of basic data statement lines. Also it is a lot faster to have a boot program loaded which then loads the data file directly into memory than it is to load a program which contains a large number of data statements which it then reads and pokes into memory one by one.

Note that in other magazines the programs listed sometimes are in hexadecimal which is no problem, however the checksum at the end of each line is not just the simple addition of data statements of that line. Also some programs listed have one checksum where this is the total addition of all the data statements. Sorry, but we cannot have everything! It is good to see that the program listings in *Your Commodore* are in a standard format.

First Steps

When an error message appears on the screen the greatest culprit is the programmer.

By Norman Doyle



There's nothing more irritating than the sinking feeling you get when a program is chugging along nicely and the screen scrolls up a few lines to reveal an operational error message. What's even more annoying is the knowledge that ten times out of ten the programmer is at fault rather than the program!

Planning is part of the secret of producing perfect programs. Those that just grow, turn out like the plumbing in my house. Whenever I turn on the tap, water of the correct denomination appears instantly, the central heating circulates well and the toilets flush perfectly – but all is not well now that I want to change things to suit all my new needs.

The problem is the rather inelegant way the plumbing resembles a collage of pipes contrived during Picasso's wildest dream. As Cubist sculpture, it's fine until it comes to untangling the mess and I'm now in danger of flushing with hot water and filling my kettle from the central heating system! One false step and the result is chaos.

So it is with Topsy programs. If your program just 'growed' and you want to make a small change these are the errors you could meet:

NEXT without FOR

When a FOR/NEXT loop has not been closed properly because a next statement has been omitted, or in some way avoided, through bad program structure, the operating system cannot trace back to the FOR statement and this error is generated.

Apart from carelessness, problems can be caused by various syntax problems. Take this example of badly nested loops:

```
10 FOR A=1 TO 100
20 FOR B=0 TO 7
30 NEXT A:NEXT B
```

The A loop will execute without any problems but, when the program meets the NEXT B command, the program jumps back to line 20 and then tries to execute the NEXT A on line 30 again. Since the operating system has declared the A loop finished and forgotten, the error message is generated.

If the variable tags A and B had been omitted from line 30, the program would have executed without any problems. This is one case when perfect syntax isn't necessarily the best policy!

RETURN Without GOSUB

The routines associated with GOSUB are often bunched at the end of most programs. This is a situation when the END statement should always be inserted before the first subroutine. If this is not done the program reaches the logical end of the program but then runs into the subroutine, finds RETURN and has nowhere left to go so the error appears.

```
10 GOSUB 30
20 REM THIS IS WHERE END
SHOULD BE
30 FOR A=1 TO 10
40 PRINT A
50 NEXT A
60 RETURN
```

Out of DATA

This is the bane of Basic adventure programmers or machine code program loaders. Often the cause is

difficult to trace but usually it's an extra comma at the end of a DATA statement or a full stop instead of a comma within one of the many lines.

In my experience, the best way to track down the problem is to add a few lines at the end of the program which read the data and prints each item to the screen. For example, if there are 312 items of data the extra lines would be:

```
60000 FOR A=1 TO 312
60010 READ A$
60020 PRINT A$
60030 GET B$:IF B$<>CHR$(32)
THEN 60050
60040 GET B$:IF B$<>CHR$(13)
THEN 60040
60050 NEXT
```

By running this with RUN 60000, the data will appear. Watch for any blank lines or unexpected results and press the space bar to halt the program. Check the DATA and then press RETURN to continue. You'll soon see if the DATA is incorrect or if there's an item missing.

Out Of Memory

Officially, this means that the program is too long for the memory space allotted to it. Always bear in mind that the program memory also includes the space reserved for variables as well as the program itself. A sure way to overrun the computer in a one line program is to try this:

```
10 DIM A$(255,255)
```

The memory isn't large enough by a long way. Be careful when using arrays, they can kill a program before it gets past the first line.

Another way to generate the error is by loading a machine code routine to 49152 and then trying to load a Basic driver. Always follow a high memory load by NEW, it won't hurt the loaded program and resets the pointers ready for a normal Basic load.

Undef'd Statement

This appears when a GOTO or GOSUB statement tries to jump to a non-existent line. A line may not exist for one of two reasons: it may have been erased in error or it may never have existed in the first place.

The latter case is easily corrected but the former may not be so easy if the disappearance of the line is due to the use of a renumber routine which does not update jump instructions.

Another reason could be through the elimination of REM statements. Many programmers get into the seemingly neat habit of placing subroutines at lines such as 1000, 2000 etc. Laudable though this may be, they then indulge in the equally good practice of turning the first line into a REM statement to label the routine. The mistake is to use the REM line as the jump address, as in GOSUB 2000, when the first active Basic line may not start until line 2020. Ideally, a program should be written so that all of the REM statements can be erased to leave the program fully operative. Stick to this rule and you may never see the undefined statement message.

ReDIM'd Array

When a variable is dimensioned it should be given its values as close to the beginning of the program as possible. Never dimension a variable immediately before it's used because future modifications may cause the line to be processed a second time and the redimensioned error will occur.

To redimension an array within a program means that the CLR command has to be used first. This will annul all of the variables that have accumulated whether dimensioned or not.

Always remember that an array cannot be altered within a program simply by inserting a new DIM command.

Illegal Direct

Some commands can only be used within a program and not in direct mode. You can type and use PRINT A$ but you cannot use INPUT A$.

This rule applies to the GET statement as well as INPUT. The file versions (GET # and INPUT #) will not work in direct mode either.

Break

This is not so much an error as an information message. It only appears when a deliberate act occurs, such as pressing the RUN/STOP key or inserting a STOP statement within a program.

When the command appears during the execution of a program the message reads something like BREAK ERROR IN LINE 210. This is the line that was being executed when the break was made.

Can't Continue

After a break or STOP interruption, the program can usually be restarted with CONT. If a line is edited after the break, or if the program hadn't even been RUN, the computer can't CONTinue and tells you so.

If a syntax error has occurred, the CONT command will also generate this message.

Syntax

Last but not least, the most common error is denoted by this message. It is probably the first error message that any computer user will encounter and results from incorrectly keying in a command. Often the fault is a typing error such as PIRNT or PRIT instead of PRINT but it can also appear if incorrect parameters are given along with a command.

One other cause occurs when a reserved word (Basic command) is embedded in a variable name. The temptation to use variables like MONEY, DIFFERENCE and TOTAL should be resisted because they hide keywords ON, IF and TO which would make the computer read these as:

M **ON** EY
D **IF** FERENCE
and
TO TAL

This makes absolute nonsense as far as the computer's operating system is concerned or, in other words, the syntax is in error.

One common example of this kind of error is when RETURN is pressed on the READY. prompt. The computer sees this as READ Y and usually an OUT OF DATA ERROR message will appear. If there is a program in memory with DATA statements in it and it hasn't yet been used, the READ Y will attempt to read in the first value. String DATA will generate a TYPE MISMATCH ERROR but numeric DATA will cause a SYNTAX ERROR because of the full stop after READY.

Over the past few months, First Steps has covered all of the errors to be found on the C64 and earlier Commodore machines but now the Plus/4, C16 and C128 have added several new errors and the next article in this series will be looking at these in detail.

Ingrid's Back

Level 9 is something of a curate's egg amongst software companies – good in parts. When the home micro boom started, their early adventures were head-and-shoulders above anything else produced in this country. Seemingly, they had the entire market in adventure games sewn up, but the promise never really materialised. The inclusion of graphics added nothing to their games, with decidedly low-resolution pictures that frequently had nothing to do with the location being described.

Something new was required, and the introduction of 16 bit machines soon led to the pepping up of the graphics. They were also working on the development of character interaction. The idea was that instead of just solving puzzles, the player also had to enlist the help of some of the people to be found wandering round the story.

The first two games using this system, *Knight Orc* and *Gnome Ranger,* didn't really come off. Whether this was due to a poor storyline or unfamiliarity with the system is hard to tell, but reaction was extremely muted.

Ingrid's Back features the heroine of *Gnome Ranger* in a new storyline. Returning back to her home town of Little Moaning, Ingrid finds that the town's inhabitants are under threat of eviction from one Jasper Quickbuck, who is determined to build a marina. This doesn't particularly concern the townsfolk, as they are under the impression that the eviction order is a very posh party invitation.

One of the main problems Ingrid faces is that most of the gnomes have experienced her attempts to help them before, and so are somewhat wary of her ministrations. In part one of the three load game, Ingrid must get enough signatures on a petition to protest about the development.

A steamroller threatens to knock down a farm in the second part, with part of the solution being highly reminiscent of the opening to *Hitch-hikers Guide to the Galaxy*, and something that should very much be taken lying down. Finally, the evil Jasper must be dealt with in order to ensure that he gets his comeuppance.

The parser is Level 9's usual one, which means very good indeed. Complex commands are dealt with easily, although there's no real need to use them. Likewise, there are no obscure vocabulary terms to be used. Useful commands include 'go to somewhere', follow someone, find someone and wait for someone. There are only colour pictures on the disk version, and not every location is illustrated, but those that are are of a reasonable quality.

All the gnomes have personalities of their own, and it's fun just watching them getting on with their own lives. The one main character that you'll need to make use of is your ever-faithful dog Flopsy.





Ingrid's Back is a nice, gentle game, both in story and puzzles. Certainly, it is Level 9's most humorous and indeed best game for some time. The trouble is, there's nothing to get really excited about. I can remember back in the early days of games such as *Dungeon Adventure*, really looking forward to loading the game in again and trying to discover something new. That feeling is sadly missing here. I can imagine my granny watching over my shoulder and not finding anything to complain about, and that I suspect is half the problem. Adventures should be thrillers, not Mills and Boon.

Touchline:
Title: *Ingrid's Back.* ***Supplier:*** *Level 9, PO Box 39, Weston-Super-Mare, Avon, BS24 9UR.* ***Tel:*** *0934-814450.* ***Price:*** *£14.95 (both formats).*

Driving Ambition

Buying a disk drive is the first step, but where can it all lead?

By Kerry Fowler

Ask an American Commodore owner about a datasette and most of them won't know what you're talking about. They may have seen one but few actually use them. In the USA, disk drives rule supreme.

Before the appearance of cheaper drives over here, cassettes were the normal storage medium and tedium was rife. Although cassettes still account for the majority of storage devices, drives are much more common now and you probably know someone who owns one even if you haven't got one yourself.

Commodore 1500 series drives cost a small fortune even when compared to the price tag on disk drives for the Amiga. The reason for this is that the drive is an intelligent device, containing its own 6502 processor. The advantage of this is that the drive doesn't use up very much of the host computer's memory with a massive disk operating system (DOS). Processors and their related chips are expensive, and buying a drive is almost identical to buying a computer from an electronic viewpoint, hence the expense.

It all started with the old PET computers and their 4040 drives. These were often supplied as twin drive units housed in a casing that would occupy an area about four times the size of the 1500 series drives. These drives were used as the models for the 1540 disk drive which was devised to accompany the VIC20 computer. You may have wondered why the syntax for disk communications contains a value for a drive number even though it's always zero. This is a throwback to the 4040 days, because both drives had the same device number (8) but one drive was set as drive 0 and the other was drive 1.

This is not the only hangover from the old days. Examine the User's Manual and you'll find an entry for the DUPLICATE command which says that this is not for single drives. This does not mean that it will work if you buy a second drive because it requires a *drive* number of one rather than a *device* number other than eight. Similarly, the copy command will only copy a file under a different name onto the same disk. On the 4040, this was not the case.

Some of the imported features are not so amusing. The well publicised save-and-replace bug which makes this command a dodgy one to use has most people using the SCRATCH command to remove a file and a normal SAVE to restore the updated version of the erased file.

The 1540 gave way to the faster (believe it or not!) 1541 and 1541C for the C64, Plus4 and C16 which, in turn, gave way to the 1570 and 1571 for the C128. All the drives are compatible and can be used with any of the machines but the 1541 will not handle differently formatted disks, such as CP/M or MS-DOS, for the C128 and the machines devised for the 1541 can't easily access the C128 drives' advanced features. Some of the older, software-based fast loaders can't operate on the 1570/1 and the best advice is to buy the drive designed for your particular machine, no matter what a fast-talking salesman may be trying to fob you off with.

The Plus4 and C16 computers had their own drive which was rather revolutionary. Prior to the appearance of the 1551, Commodore had settled for serial communications for both drives and printers. This means that all information is sent down a single wire as a long queue of bits rather than bytes. The 1551 used parallel communications which meant that data was taken in through the user port a whole byte at a time. Simple mathematics shows that this improves data transmission eightfold and the actual improvement was even greater than this.

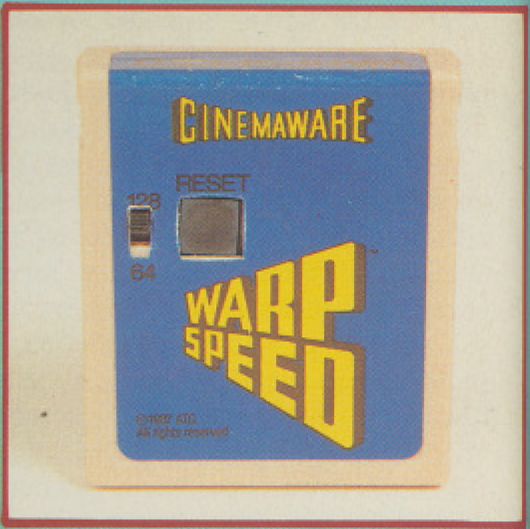
The 1551 didn't catch on and Commodore reverted to serial drives



Action Replay

for the C128, but this was not an end to their experiments. Recently, the 1581 has appeared which combines the capacity of a 3.5 inch disk with faster disk access. It's an excellent drive but fated to be the preserve of those who keep large databases or who wish to standardise their new 16-bit machine with their trusty old 8-bit.

Add to these drives the two indies,



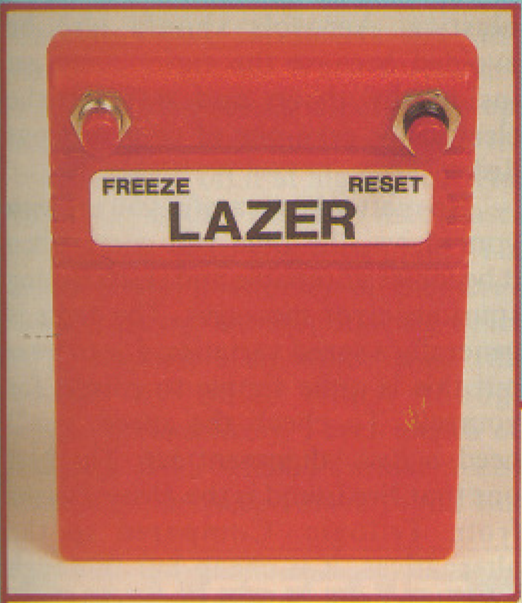
Warp Speed

Oceanic and *Blue Chip*, and you have the full range.

The Range Loner

The problem with such choice is which utilities work with which drives. Left to their own devices, the lone computer users can fall foul of the wide choice of add-ons which are totally unsuited to their system.

Plus4 and C16 owners are treated like hi-tech lepers as far as the hardware companies are concerned. Any benefits are spin-offs of the drive compatibility with the C64 but cartridges, DOS boards and alignment kits are just three things that they can merely dream about. Most of the utilities are aimed at the C64 and 1541 combination.

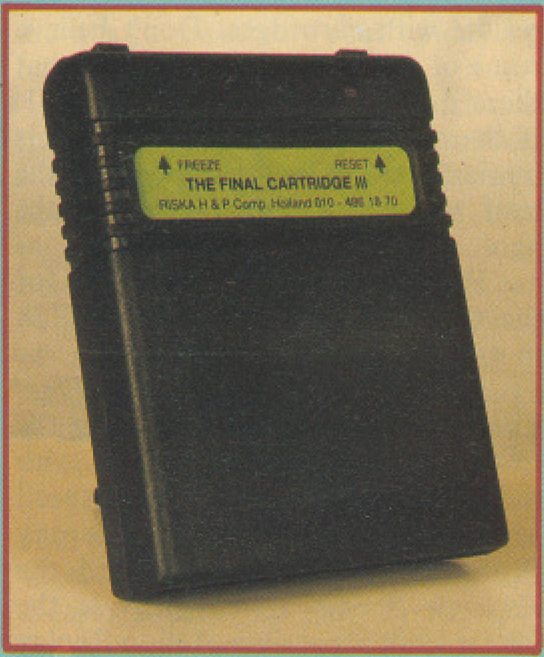


Freeze Frame

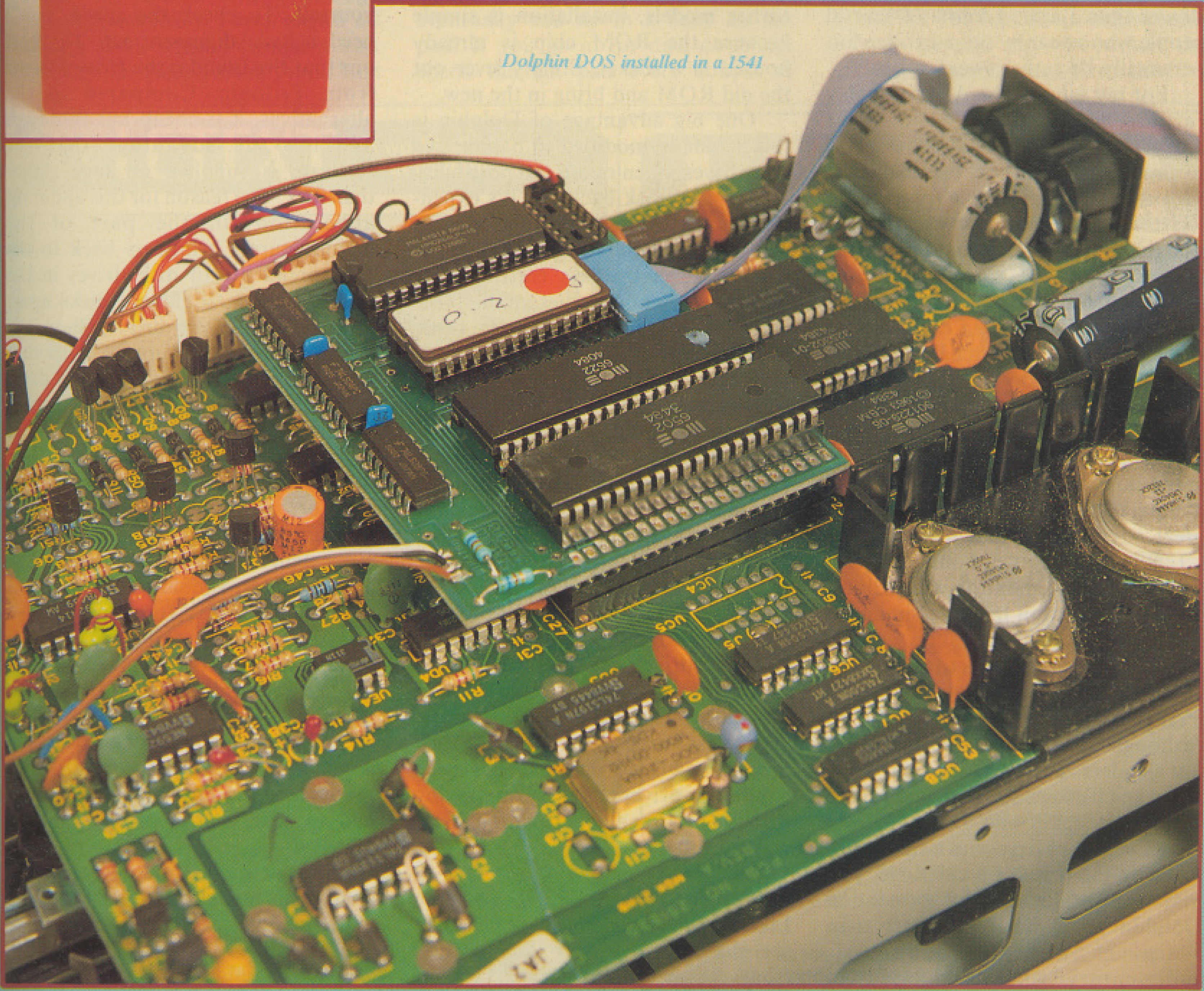


The Expert

C128 owners can take heart in that its natural compatibility makes the majority of the C64 range available to them, but only in C64 emulation. The indie drives are very good, compact and relatively cheap but incompatible with systems such as *Dolphin DOS*, though they often produce good



The Final Cartridge


Dolphin DOS installed in a 1541

results with cartridges. Don't believe some of the literature that claims that these drives are faster than the 1541. If there is any difference at all, it is minimal and failed to show up in the tests we performed several months ago.

There are four main cartridges for the C64 and only one for the C128 in its natural state.

The *Expert, Freeze Frame, Final Cartridge* and *Action Replay* form the C64 line up (all are compatible with the C128 and 64 mode). As far as speed is concerned, the Action Replay Professional IV's *Warp 25* and the *Expert's Rocket* system provide the fastest loaders possible. Action Replay has a slight edge because it is easier to use, but the Expert would be a better overall bargain if Trilogic would release the secret of programming its RAM chip. Freeze Machine's *Lazer* system runs at about half of this speed and has fewer utilities on offer. The Final Cartridge is bristling with facilities, but its fastload is slightly slower than Lazer. I know of several people who swear by this cartridge but personally I'd rather swear at it.

For my money, the Action Replay cartridge wins hands down both on the grounds of speed and facilities. This is especially true for drive owners because the monitor can be used to write and execute programs for wedging into the disk drive's operating system.

Financial Systems Software market the *Warp Speed* cartridge for the C128. This is switchable for use in the C64 mode or C128 mode. Although it works with a straight C64 machine, I can't really recommend it because, despite its go-faster name, its speed loader is pathetic even when compared to the Final Cartridge. It's great advantage is that it is the only C128 specific cartridge and sports a very impressive monitor which has a drive interrogation function similar to the Action Replay together with an impressive range of toolkit-type commands.

Porpoise Built?

Although there were three hardware fast loaders available at one time, Datel and Trilogic seem to have pulled out of the stakes and *Dolphin DOS* from Evesham Micros has a clear field. At twice the price of a cartridge, you may be wondering why I mention Dolphin at all. It is no faster than Warp 25 and its monitor is rudimentary when compared to Action Replay. Its one main advantage is that it doesn't use a special disk storage format which is the secret of Warp 25 and Rocket. Instead, it uses parallel loading to increase its speed. This means that it will load ordinary programs and the majority of commercial programs at lightning speeds.

The one disadvantage of Dolphin is that it relies on a chip change in the computer and the disk drive. The drive modification is fairly easy to do but the replacement ROM for the computer can be awkward. This is not a job for the rank amateur because most ROMs are securely soldered into the circuit board. When I installed my Dolphin DOS, it meant desoldering the original ROM, fiddling about soldering in a chip socket and after that it was plain sailing. The risk is obvious, one small slip of the soldering iron and you can wave goodbye to your 64.

The C128 modification only works in C64 mode with a 1541 but, with earlier models, installation is simple because the ROM chip is already housed in a socket. Simply lever out the old ROM and bring in the new.

One big advantage of Dolphin is that it can be modified to handle two disk drives, opening up the possibility of superfast disk backups. It's expensive but very highly recommended as the fastest standard disk system on the market. Even the best cartridge can only load standard files at half the speed of Dolphin DOS. On the other hand, owners of indie drives can forget about this system because it's devised solely for the 1541.

A cheaper solution to disk backups lies in the *Fast Hack'em* disk from Datel. This carries a variety of copiers and nibblers but one facility which is particularly spectacular is the two drive auto disk copiers. These wedge a program into the drives which takes advantage of their intelligent chips. Once the program is loaded from the C64, the drives can be disconnected from the computer and left to do their own thing. The speed is amazing and takes less time than normal disk formatting. Once one disk has been copied, the drives will carry on copying with new master and destination disks, very useful.

Care Ware

Like cassette heads, the drive head can get clogged up with oxide residues from the recording surface. This is especially true if you use cheaper disks. Various companies produce cleaning disks which will remove the oxides but the problem is that these products often carry instructions for use with PCs. To use them with a Commodore computer, place the disk in the drive and close the flap. Next, execute a disk formatting command and the drive will whizz round happily, cleaning as it goes.

Most proprietary cleaners will remove dirty finger marks from the drive's plastic casing, but be careful not to choose a cleaner which contains solvents that are unsuitable for use on plastics. Aerosols should also be avoided because the spray could get inside the drive and damage the electrics or even one of your precious disks.

No matter how careful you are with your drive, the time will come when it becomes unreliable and starts issuing spurious error messages. The cause is generally a speed variation due to wear but this is quite simple to correct for yourself. To check the speed, you'll need a disk alignment kit. The best one that I've found is the *Drive Doctor* from Trilogic. Compared to the alternatives, it is cheap but thorough and has the advantage that the software is supplied on tape rather than disk. The reason for this apparent abberation on the part of the manufacturers brings us back to the widespread use of disk drives in the States. All the alignment disks apart from Trilogic's are produced in the USA, where it is a fairly safe bet that a friend will have a working drive which can be used to load the software. In Britain, this is not so likely and Trilogic are to be commended for using their common sense. Drive Doctor runs speed, hysteresis, alignment, stop position and movement tests on the drive. The alignment test should only be used as a last resort. Investigate the possibilities of dirty or broken mechanical parts or electronically based speed problems first. If these fail to show up any fault then you may as well try re-alignment because, even if you can't actually fix the drive at the end of the day, you would have had to send it away for re-aligning anyway!

The small but beautifully formatted manual that is provided with the kit also carries a warning about quiet stops. These are little wire clips that replace the heavier metal

stops which are supplied with the drive. As far as I'm concerned they are simply another application for a paperclip. Quiet stops are purely cosmetic devices which stop the drive from making that loud hammering noise when formatting a disk. The stop is hard stop for one good reason, the drive uses it so that it can orientate itself with relation to the disk. If the stop gives slightly, and a quiet stop certainly does, the head will lose track of its real position, formatting will be off line and the odd error message will be returned.

While I'm on the subject of dire warnings, fast formatters are also pretty evil devices. When formatting starts, even the most solid of hard stops is subjected to violent vibrations as the head bounces off it at high speed. This can even fracture the resin that is used to hold the stop screw in place. The result is the possibility of the screw slackening and the stop moving which is a situation even worse than that caused by quiet stops, though somewhat less likely. I even switch off Dolphin DOS when I format a disk these days because I have found that occasionally a disk is incorrectly formatted. The problem with this fault is that it doesn't show up until I start to use the disk.

Bits and Bobs

Disk doubling may be classed as another bad practice but so far I've had no trouble. This is the rather logical act of cutting a write enable notch in the opposite side of the disk so that it can be turned over and used upside down. This means that the reverse side of the disk can be used to store information. Referred to as flippies, these disks have twice the storage space of the undoubled disk.

There are two potential problems that can arise with a doubled disk. First, the disk may be classified as a single-sided disk because it has failed the quality test on its reverse surface. Secondly, the normally unused side of the disk runs on a felt pad which causes friction and can rub off the oxide coating. With a doubled disk this means vital sectors may wear thin and eventually end up in a heap on the pad! If you go in for disk doubling, check the felt pad every couple of months to make sure that oxides are not building up.

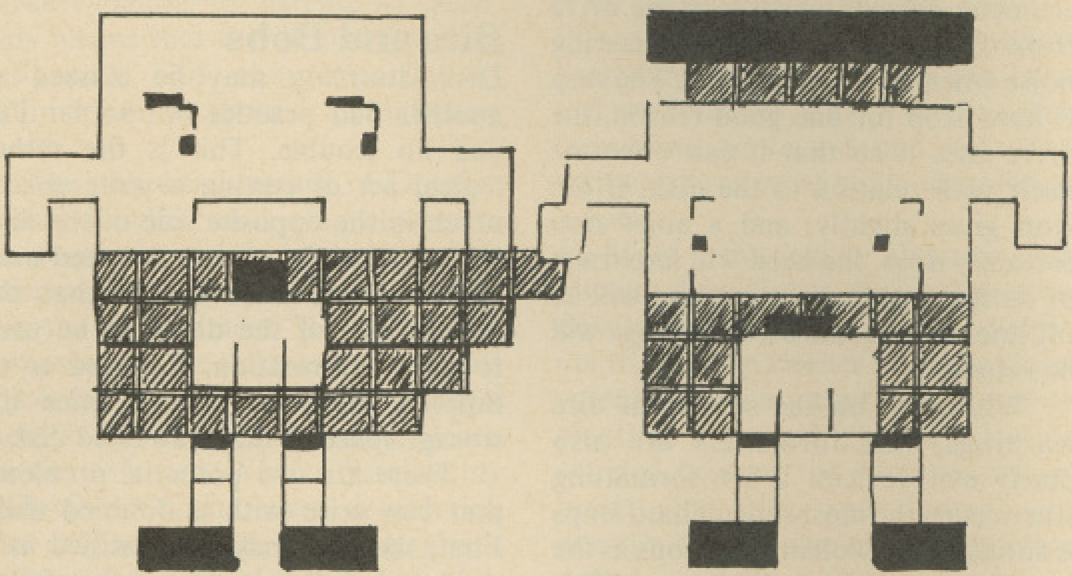
Disk Notchers can be purchased from Datel and quite a few computer shops but, if you're not too bothered about the disks appearance, a hole punch such as those used for making holes in paper for clip file storage can be pressed into service. It's all a case of accurate positioning. Cut too shallow and you'll not remove enough of the sleeve, cut too deep and you'll perforate the disk itself.

Finally, just a short mention about disk boxes. Don't be seduced by the latest compact box which folds out like a cassette case – it may be too easy to trap your disks when you close the box again. I favour the boxes which have a lift-up lid, they generally hold more disks and they offer better value for money because they're less likely to get broken.

Look after your drive and it will last for years. Despite the heavy use and ill-treatment my drives get, they have lasted for five years. That doesn't mean that I've had no problems with them, otherwise why else would the editor have asked me to write this?

Sprites over the border can be easier than you think

By Eric Doyle.

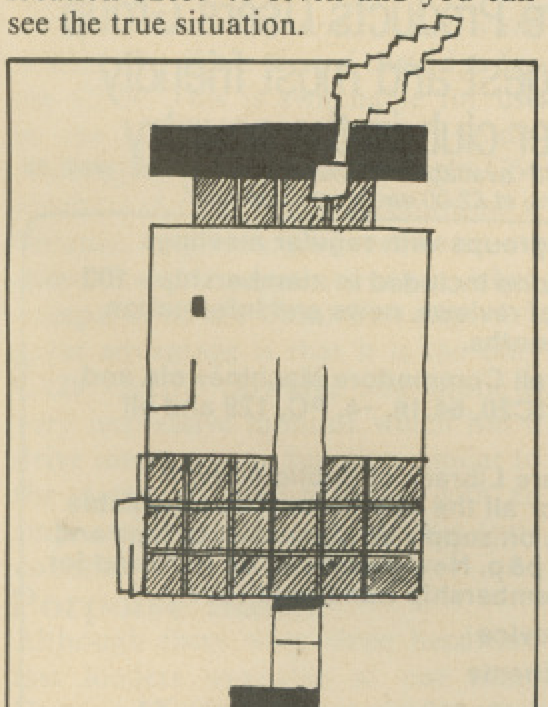


May I Interrupt?

For the final article in this series I thought that it would be best to leave everyone with something to think about. Basically, I'm dealing with sprites in the border. Commodore said it couldn't be done but many programmers, from Jeff Minter and Tony Crowther downwards (or upwards for that matter), have proved that it is not only possible but also practical.

Type in the first listing and run it with SYS 49152 to see what sprites in the border look like. Isn't it wonderful? Well, one thing I'd like to say is that there aren't any sprites in the border. No, I know you can see them but they're not actually on the border!

Examine the disassembly and we can see what's happening. The screen is split at raster 32 and F9. What's happening is that the screen colour changes between position F9 (near the bottom of the screen) and position 32 near the top. These more or less coincide with the border position and the program further convinces the viewer by changing the screen from dark blue to pale blue. Change location $2039 to seven and you can see the true situation.



Now we have a screen which has a screen colour and two different border colours. We've extended the screen interrupt to colour over the border. This is now inaccessible screen space. There are no memory locations for the band at the top and bottom of the screen. As you can see, inaccessible is not strictly true because the sprites can access this area and, thanks to the border no longer existing, they can be seen.

If you examine the programming of the sprites you'll see that there is nothing particularly clever going on. The only special treatment is that some of the sprite location values used wouldn't normally be accessed for visible sprites.

The positioning of the raster interrupts is crucial but you might like to alter them to see what happens. The values are stored at $C003 and $C004 so with the interrupt running the values can be changed from Basic with POKE 49155, XXX and POKE 49156, XXX. Try values of 252 ($FC) and 247 ($F7) respectively to start with.

Border sprites are really just a whimsical use of the interrupt facilities but they show all of the basic elements.

First of all, the interrupt must be se up after suspending the IRQ system. This is done with the SEI command. Now the parameters can be changed without fear of a crash resulting. Next the locations $DC0D and $DD0D must be set correctly. The start location of the routine which is called during each IRQ should then be stored in locations $0314 and $0315 in low byte/high byte order.

Now a decision has to be made. Will the interrupt be linked to the raster scan or just happen whenever it can? If raster linked the point must be set in location $D012. Such applications would be for screen splitting, scrolling, border sprites, more than eight screen sprites at a time or for occasions when the screen is disrupted by a slightly longer interrupt.

Location $D01A should now be set, then the interrupts can be recalled by CLI and the routine left via a standard RTS.

Apart from the essential program within the interrupting routine certain other elements should be included. Most importantly, location $D019 must contain a value of one. This can be done at any point within the routine, I normally include it as part of the exit routine.

Another consideration is whether a keyscan is needed. If it is, the final command should be JMP $EA31. If the scan is not required the registers must be reset.

When an interrupt occurs, the current accumulator, X register and Y register values are pushed onto the stack. Any routine must clear all of its own parameters off the stack even before the JMP $EA31 command. If this is not done, there is a danger that the computer will crash when the interrupt is over.

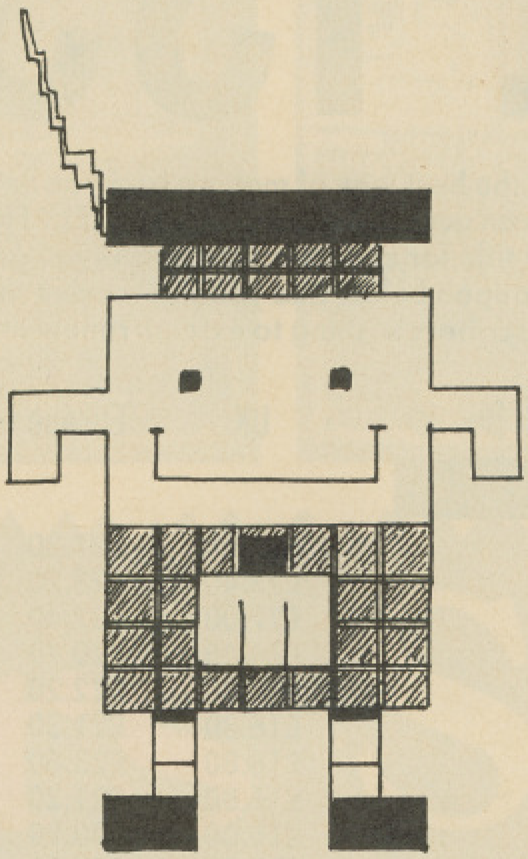
To reset the registers use this routine to close the interrupt:

```
PLA
TAY
PLA
TAX
PLA
RTI
```

Sometimes it is necessary to have two or more alternating interrupts. During each interrupt routine locations $0314 and $0315 must be changed. It's not necessary to turn off the interrupts this time and you'd be ill-advised to do so because the routine itself is the interrupt. Simply poke the low and high bytes into the correct locations. If the two routines form a double split for screen manipulations, the raster value at location $D012 will also have to be changed.

The best way to come to terms with interrupts is by experimentation. Things won't always go your way but you'll soon become proficient at knocking up routines that will stun and amuse your friends.

In the interests of clarity, I've not used the most efficient routines possible so that could be a starting point for learning. Go through your back issues of May I Interrupt and see if you can compress the routines to save memory by using an interrupt counter. This is an alternative to resetting the locations at $0314. A byte of memory is laid aside to act as a counter. If your example has two alternating interrupts, the location, or flag, is set to zero initially. Loading this into the accumulator will set the zero flag in the status register so a simple BEQ command will execute the correct routine. In this branch routine, the flag will be set to a value of 1 and the next time the interrupt is executed it will skip the BEQ branch and execute the second routine which follows on.

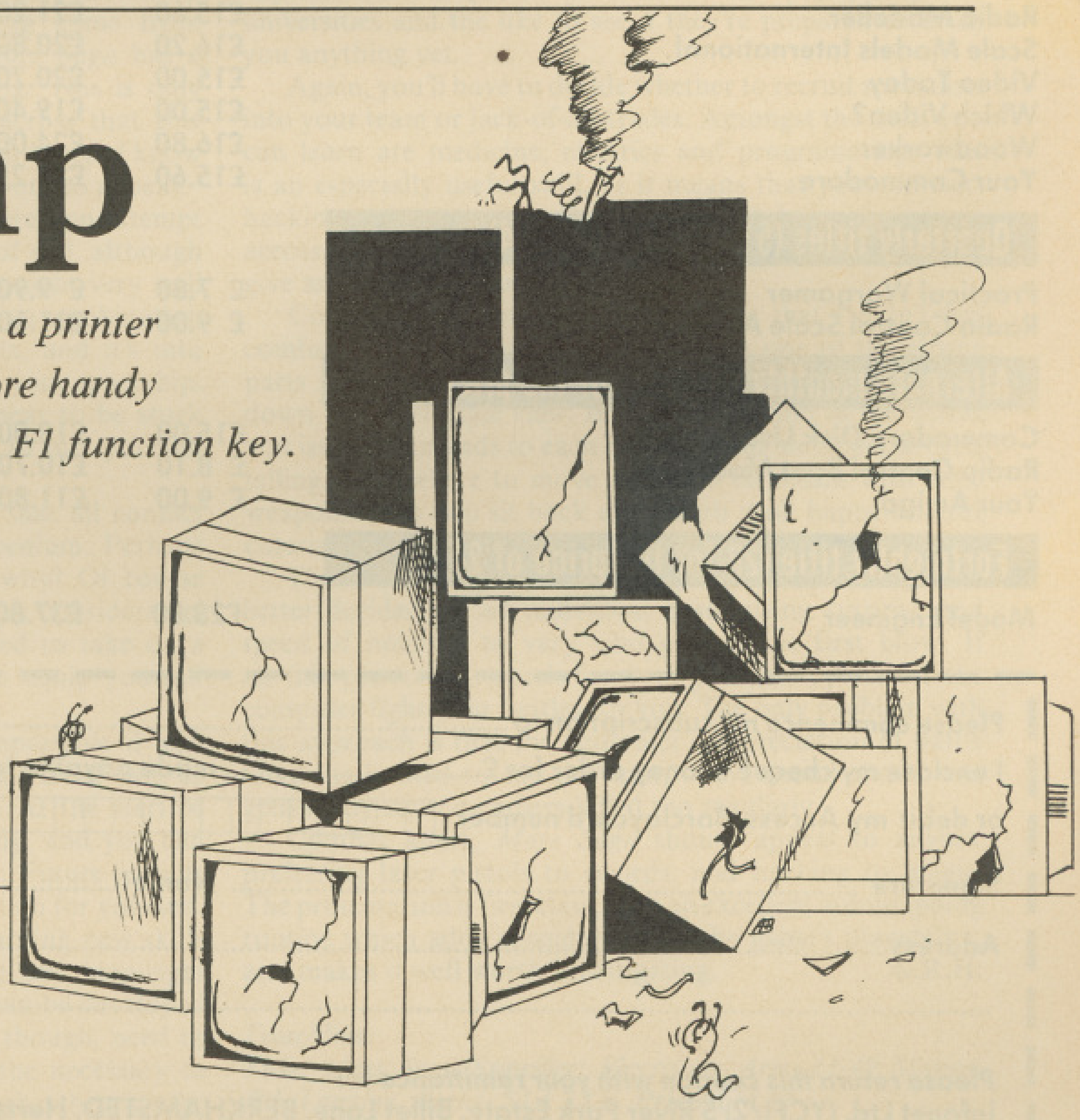


The series has, I hope, given food for thought and guidance to those whose curiosity outstripped their technical knowledge.

In future issues of the magazine you'll find many other examples of interrupt-driven software which you should now be able to understand more easily. Well it's time to pull the plug and execute a final RTI to mark the end of the series.

FDump

Dumping your whole screen to a printer can be very useful. It's even more handy when the dump is linked to the F1 function key.



FDump is a very simple idea. It's a small routine that sits in memory, from 49152 onwards, and will send a whole text screen to the printer every time you hit the F1 key.

The program is initially activated by entering SYS 49156. If, however, you want to use FDump frozen inside a Basic program, or in direct mode, SYS 49191 will do the trick.

Getting it in

The program is a small machine code routine in the form of a Basic loader. For advice typing it in, see our Listings page.

By N J Burton

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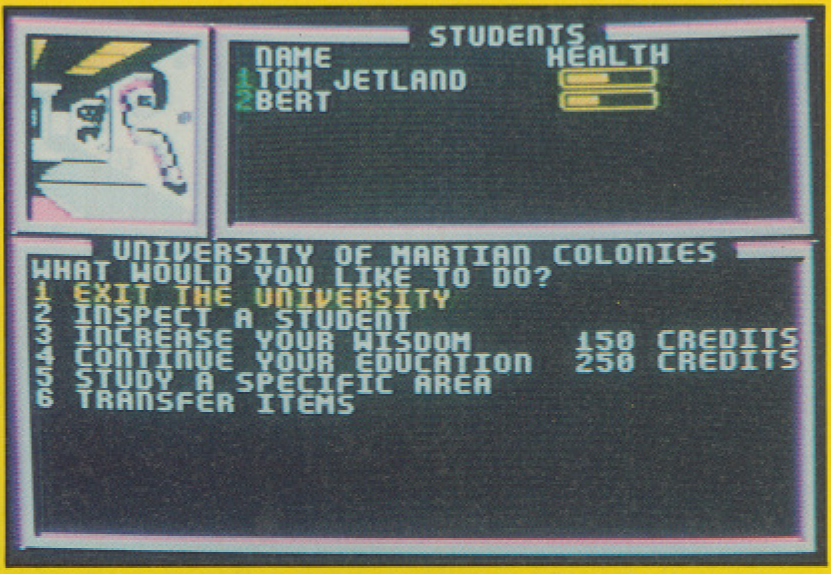
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Mars Saga

Not one but two unusual features made me sit up and take note of this role-playing game from Electronic Arts. To start with, *Mars Saga* has a science fiction rather than a fantasy setting. This is only the second game of this type I've come across that gets away from dwarves, dungeons and the like, although I know that several other futuristic titles are also about to appear.

The second feature is the storyline, where you attempt to save yourself rather than rid the world of evil, although I suspect that accomplishing the first part might very well involve the second. The year is 2055. Mars is a combination of prison colony and mining deveopments, and it's into this environment that you manage to crash your spaceship. As your craft is a total write-off, you appear to be stuck here until you can learn sufficient credits to buy yourself a new one.

Searching around for a job, you hear that all contact has been lost with a new outpost at Proscenium. Perhaps you might be interested in investigating why? Of course you are, even though the threat of danger is considerable. Before you get that far though, you'll need to take on a few other little jobs to earn the money to equip yourself properly.

You also discover that the task is impossible if you attempt it single-handedly, so a visit to the local bars to try a spot of recruitment is also in order. At the start of the game, would-be heroes are ten a penny, and you can only persuade one other person to join you. Future recruits come only when you start earning a reputation for yourself.

Character development is based on learning new skills – how to use different weapons, learning new languages and so on. Some skills such as gambling can be developed through constant use. Most of the others though, need to be learned, which in turn means paying the necessary to be trained. You can only progress though when you're experienced enough, so you have to keep popping into universities and the like to see if they're prepared to teach you anything yet.

Again, you'll have to decide whether to recruit specialists into your team or jack-of-all-trades. Amongst the skills you can learn are medicine, electrics and programming. This is an especially useful skill, as it means that you can start hacking your way into the various databases you come across, as you try to gain access to information that might give an important clue.

Combat is the one area of the game that I didn't feel comfortable with, though it is hailed as one of the strong parts of the game. The battlefield is presented as a top down *Gauntlet*-style view. Before each round of the battle, you issue commands to each of your team members in turn, telling them where to move and who to attack with what weapon. Then you sit back and watch it all happen before entering your instructions for the next round.

The result though is one confused mess. Combat is much better decided on an individual basis, using surprise and speed of reaction to vary who gets in the first blow. If all this proves too much for you, you can opt to let the computer fight your battles for you. The only problem with this approach is that the computer's appreciation of battle tactics is limited to say the least, and I found that I was getting my team members killed too regularly.

Combat apart, *Mars Saga* should appeal to anyone preferring laser pistols to swords, and hacking to magic. The presentation is first class, with an excellent automapping routine which adds considerably to the game's playability, and makes it well worth investigating. **G.R.H.**

Touchline:
Title: *Mars Saga* ***Supplier:*** *Electronic Arts, 11-49 Station Rd, Langley, Berks, SL3 7YN.* ***Price:*** *£14.95*

Deathlord



The dwarf thief sneaks up on the magic-user and smashes him over the head with a club. Admit it – most of you would had a fair idea of what was going to happen in the opening sentence. Now try this for size. The kobito yakuza sneaks up the mahotsukai and smashes him over the head with a nunchaku. Yes, it had to happen – role-playing has gone oriental!

The only thing separating *Deathlord* from other role-playing titles is the game's setting. Even the story line is vaguely familiar – once peaceful kingdom now beset by mysterious evil forces led by an outcast wizard. The king offers gold and land to any who can dispose of this malevolent sage.

The background, although not actually set in Japan, has a decidedly Japanese setting to it. All the character classes represent the sort of class structure found in mediaeval Japan, from the peasant kosakus to the mighty samurai warrior and secretive ninja.

Weapons and armour also have Japanese names, as do the four classes of spells. To anyone who has ever

Last Ninja II

When System 3 released *Last Ninja* at the end of 1987, everyone, including cynical old me, thought that it was the last word in kung-fu games. The stunning 3D-graphics and combat games tied into an arcade adventure was a winning combination. I suppose, in a world full of sequels, (*Bard's Tale III* and *Ultima V* for example), we shouldn't be surprised that there were more on the way.

Once again, you control the invisible warrior, the new ninja master Armakuni, who gained the highest office after completing the last game by purging his own order and regaining control of the island of Lin Fen. So, you're involved in a training session with the elite ninjas when suddenly a pulsating light surrounds you, and you're ripped from you own time and space only to reappear in the middle of Central park, New York, for another battle with your arch enemy Kunitoki, the evil Shogun.

You begin the game confused, but confident of your fighting abilities, despite the fact you have no idea where you are and what you will face. To make things worse, you materialise trapped inside a bandstand. Behind a curtain, you find a backroom and your first combat opponent, but a few well-timed kicks and punches should floor him and reveal the way out into the park itself. There you will find policemen who have been corrupted by Kunitoki and attack you on sight. Most are unarmed, and fight you on equal terms, but others wield clubs and some even throw shuriken stars, so your first task must be to find some weapons and equal the odds.

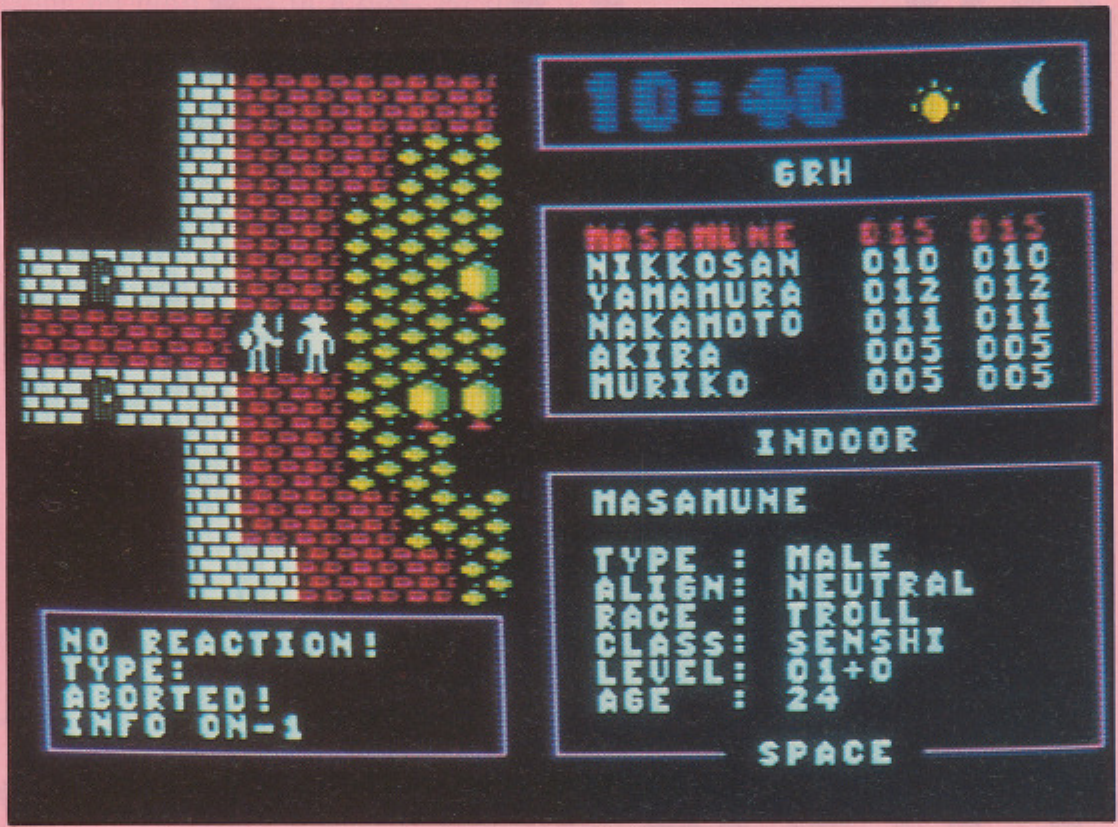
These weapons, and other useful objects, will appear in the most awkward places, either behind a particularly tough opponent, or on high narrow ledges that may cost you one of your four valuable lives. Once you're suitably armed, you may live long enough to escape from the park into downtown Manhattan.

Out in the city, you'll face new

played *Dungeons and Dragons*, these correspond roughly to cleric, druidic, magic user and illusionist-type spells. Unfortunately, the name of any spell to be cast has to be typed in full, so that means more Japanese to learn. Why a system of mnemonics or a menu couldn't be used I don't know but, the result is decidedly user-unfriendly.

All commands are entered as single keystroke entries via the keyboard, more or less a direct crib from the *Ultima* series of games (in fact the whole game has a decided *Ultima* feel to it, right down to the graphics). Not all of these are easy on the memory though, and I kept typing 'O' to open something and finding myself in the speech menu (O=orate). Having said that, once you do decide to talk to someone, you have several options available to you. 'Chat' starts a general conversation, whereas 'talk' attempts to elicit information, although you usually have to pay for this. 'Inquire' allows you to ask about a specific subject. All trading is also done via the 'orate' menu.

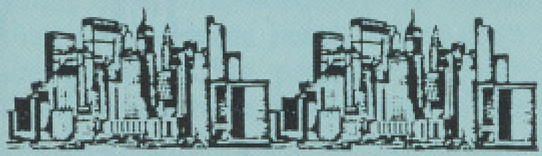
The game is set in the land of Lorn, and there's plenty for you to explore – 16 different continents, dungeons galore, caves, ruins, pyramids, ruins, towns, villages and palaces all protected by 128 different kinds of monster.

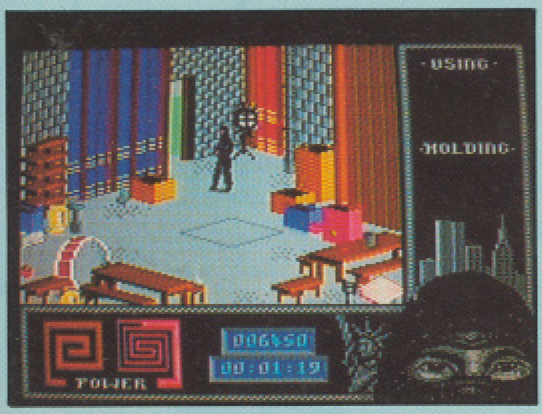


Deathlord is not in the top flight of role-playing games, but should appeal to anyone with an interest in things oriental. My overall feeling though is that it is a poor man's *Ultima* – with Japanese subtitles! **G.R.H.**

Touchline:
Title: *Deathlord.* ***Supplier:*** *Electronic Arts.* ***Price:*** *£14.95.*







dangers, including muggers, more corrupt cops, and the infamous New York traffic. Now you're beginning to comprehend the scope of your arch enemie's operation, and realise that you must stop him at all costs. There are six levels – that are loaded in separately once you've completed the previous one – which will take you down into the sewers, into Kunitoki's opium factory, through an office block and onto a final confrontation with the evil Shogun.

If *Last Ninja* had one fault, is was the fact that you could take as long as you liked over each screen in the game, which slowed down the action considerably. *Last Ninja II* solves this problem by allowing your defeated foes to recover from the beating you gave them, and rise up to challenge you again if you hang around too long. With this minor drawback removed, *Last Ninja II* is destined to repeat the success of its predecessor and go straight to the top of the charts, but only time will tell whether it's strong enough to fight off the challenge of games such as *Thunderblade, Operation Wolf* and *Afterburner*.

The game is sold in a special edition format with an instruction book, a 3D map of little value, a rubber shuriken throwing star to worry those who worry about kids having such things, and a black cotton Ninja mask that's too small to fit me. Unfortunately, this adds to the price but increases the perceived value.

As before, the key to the game is to perfect the kung-fu armed and unarmed joystick moves, so that you can defeat your foes without incurring too much damage, and concentrate on solving the games puzzles that will lead you to Kunitoki and the end of a challenging mission. **T.H.**

Touchline:
Title: *Last Ninja II.* ***Supplier:*** *System 3 (Mediagenic), Blake House, Manor Farm House, Reading, BERKS., RG2 JN.* ***Tel:*** *01-431 1101* ***Price:*** *£11.99 (cass).*

The Beginner's Guide to the Commodore Disk Drives

By Allen Webb



To many of you, the acquisition of a disk drive promises an end to the tedium and bother associated with tape. On the whole, I think that the drives deliver most of what they promise. There are however three major drawbacks:

* Since the serial port is used, the drives are a little slow.

* A full DOS is not supplied.
* The manual is up to Commodore's usual appalling standards.

Fear not – this article will give you the introduction the manual fails to deliver.

First, some general points on Commodore's approach to disk drives. One point worth remembering is that most Commodore disk drives respond to the same system of commands. If, like me, you cut your teeth on the PETs, this means that changing to a 64/1541 combination is simple and painless. The main exception is the 1571, which is a double-sided drive. Unlike many drives, the CBM disk drive is self-contained – it has its own CPU, RAM and ROM routines. This means that you can often leave the drive to perform a task while you continue to bash at the computer. Some copy packages, such as *Fast Hackem,* use this to allow two drives to work together without the computer! Similarly, some software uses the disk's routines and RAM to ensure copy protection.

Let's look at what a floppy disk is. If you look at one you will see that it is a square rigid envelope containing a brown disk. There is an oval window on each side and a small circular hole by the central opening. A notch is cut on one side of the envelope. The two windows are used by the drive to read and write data to the disk. The two small holes are called 'index holes'. The notch is the write protect – if it is covered you cannot write to the disk. The disk is inserted with the label uppermost and to the rear.

On the 1541 and 1570 disk drives only one side of the drive is used to record data. Disks are sold as either single or double-sided. On the whole they are the same beast. When disks are tested during production, those disks which have both sides of the required standard are sold as double-sided. If only one side is acceptable, they are sold as single-sided. As a consequence, you can generally use the flip side of the disk by simply turning it over, but you must accept that it may not be as reliable as the correct side. In addition disks contain a lining which collects dust off the magnetic medium. If you turn the disk over, this dust may be ejected into the drive mechanism causing problems. There are mixed views on the seriousness of this aspect and some software does come on both sides of a disk. At the end of the day you must make the choice.

The disk is subdivided into 35 concentric tracks – a bit like a record I suppose. These tracks are subdivided into sectors. Since the lengths of the tracks vary depending on their position on the disk, the number of sectors per track also varies (from 16 to 20). When you get a new disk, the medium is quite random and useless for storage. Before you can use the disk you must Format it. This action lays down the track and sector pattern as a sequence of magnetic information. As part of the formatting process the system allocates Track 18 as the Block Availability Map (BAM). The BAM keeps track of where files are stored on the disk and the information needed to create the directory. But that's enough technical stuff – let's get on to using the drive.

In order to use the drive you need a disk operating system (DOS). The DOS provides the means by which you can copy, delete, rename files and get the directory. The main drawback with the CBM systems is that on the whole, no simple means of sending DOS commands is provided. There are, however, add-on packages which give easy access to DOS commands (more on them later).

You will note that the default device number of the disk drive is 8 (you can change it but it involves some surgery under the drive's lid). In the old double drives, the individual drives were assigned 0 and 1 to allow you to differentiate between them. Nowadays, the single drive is assigned an identifier of 0. You can append this identifier to any DOS command.

The prime piece of information available is the directory. This is LOADed as a simple BASIC-style file which is then LISTed. This is done by using:

```
LOAD"$",8
```

There is a draw-back to this method of getting a directory. Since the directory is loaded as a BASIC type file, it will overwrite any BASIC program already in the machine. The only way around this problem is to use a machine code routine to display the directory direct to the screen. Figure 1 shows an example of a directory.

Figure 1

0	"MYDISK"	00 2A
20	"PROGRAM 1"	PRG
33	"FILE"	SEQ
611	BLOCKS FREE	

The top line tells you about the disk's name. The zero on the extreme left represents the drive number. Next comes the disk name followed by the two character identifier. The 2A represents the version of DOS used. The files on the disk are listed below the header line. The left hand number represents the size of the file in blocks (one block is 256 bytes long so you can easily work out how big a file is). Next comes the file name and lastly the file type. There are several different types of file. The most commonly encountered types are:

* PRG – This is assigned to a BASIC program.
* SEQ – This is a sequential file.
* REL – This is a relative file.

The BLOCKS FREE message is self explanatory. On an empty disk you have 664 blocks (about 170K) free.

The SAVE, LOAD and VERIFY commands operate exactly as with the cassette drive, except that you use a device number of 8 or 9 (as mentioned earlier). Similarly, a secondary device number is used to force a LOAD to a specific address. ie:

```
LOAD "MYFILE",8,1
```

There is also a REPLACE and SAVE option. This has the syntax:

```
SAVE "  0:MYFILE"
```

Normally if you try to SAVE a file to disk with the same name as a file already on the disk you will get an error. The REPLACE and SAVE option overcomes this problem and over-writes the file. It has been said, however, that this routine might have a bug in it which leads to the joining up of files on the disk. It is believed that this occurs when the disk is getting full and there is insufficient space for the new file. The bug is certainly recognised on the early DOS1 but it is uncertain whether later versions have it. The bug is fairly insidious and its effects may not become immediately obvious. I never use the

REPLACE and SAVE option. I either SAVE files as a sequence of versions (eg SOURCE.1, SOURCE.2....etc) with periodic weeding of the oldest versions or delete the previous version before saving the new. This approach has never given me any problems.

The main route to the disk drive is by opening a command channel and then sending the command down it. This channel (number 15) can be opened with:

OPEN 15,8,15

This is followed by the DOS command in quotation marks.

Let us consider the format (NEW) command. When you format the disk you must supply a disk name and a two character identifier. Imagine that you want to format a disk with the name "WOMBAT" and the identifier 99. The format command then has the syntax:

OPEN 15,8,15,"NO:WOMBAT,99": CLOSE 15

If you wish to reformat a previously formatted disk you can omit the identifier. In this case, the syntax would be:

OPEN 15,8,15,"NO:WOMBAT": CLOSE 15

It is a wise precaution not to use the same name/identifier on more than one disk. When you use a disk the disk drive reads the directory and the BAM. If you replace the disk with another with the same name and identifier, the disk drive will become confused and not realise that the disk has been changed. This can cause serious problems. Once you have formatted the disk you can proceed to SAVE and LOAD programs.

Once you have files on a disk, you will want to manipulate them. DOS offers a number of handy commands to help you.

Initialise
This command has a number of uses. It can be used to force the disk drive to read the details off a disk. It also resets the read/write head to the directory track. This latter feature is useful if a piece of software has left the head in an "illegal" position. The syntax of the command is:

OPEN 15,8,15,"I"

Scratch
This command deletes the specified file. It has the syntax:

OPEN 15,8,15,"SO:FILENAME"

Rename
This renames the specified file:

OPEN 15,8,15,"RO:NEW NAME=OLD NAME"

Here the file called "OLD NAME" is renamed to "NEW NAME".

Validate
If you have performed a number of actions creating and deleting files the operating system can have a problem reallocating disk space and thereby leave you with less storage space than normally possible. Validate will recover this space.

OPEN 15,8,15,"V"

Copy
This duplicates a specified file on the drive and has the syntax:

OPEN 15,8,15,"COPY=ORIGINAL"

The file "ORIGINAL" is copied under the name "COPY" on the same disk. This command is interesting in that it operates independently of the computer. If you try it you will notice that control is immediately returned to the computer and the disk drive quietly churns on until the copy is made.

You will have noticed that the disk drive has a small light on its front. This light glows red when the drive is working. If an error such as a missing file or disk error is encountered, this light flashes. Clearly you may want to know what has caused the error. Some errors, such has trying to LOAD a non-existent file are obvious, since the computer will tell you it can't find the file. Others are not so obvious. The answer is to use the following lines as a stand-alone program or as part of a larger program:

```
10 OPEN 15,8,15: INPUT 15,EN,EM$,ET,ES: CLOSE 15
20 PRINT EN,EM$,ET,ES
```

The variables have the following meanings:

EN – this is the number of the error (look in the back of your drive manual for details).
EM$ – this tells you what the error is.
ET – this tells you on which track the error occurred.
ES – this tells you on which sector the error occurred.

The latter two values are only of use if an error has been detected in the disk contents or when a defect occurs in the disk. You will notice that once the program has RUN the light on the drive stops flashing. As, an example, if you try to LOAD a file when there is no disk in the drive and then RUN the above program you will get the output:

74 DRIVE NOT READY 0 0

If the drive tries to read a track with an error present, it can become confused and the drive will attempt to position the head at the first track. This is attempted several times, leading to the head hammering against the end stop. Some software uses deliberately created disk errors as copy protection leading to this "hammering" every time you use the drive. This can knock the drive head out of alignment leading to read/write problems. The following simple program should disable the "hammering" mechanism (until you turn the drive off!):

```
10 OPEN 15,8,15
20 PRINT 15,"M-W"; CHR$ (106) CHR$ (0) CHR$ (1) CHR$ (133)
30 CLOSE 15
```

There are products available which help you to get over the slow speed of the drives and the fiddly disk operating system. You can find several advertisements for these in *Your Commodore* but the ones worth looking at are *Action Replay* (Datel), the *Expert Cartridge* (Trilogic) and *The Final Cartridge* (Evesham Micros). The April issue of *Your Commodore* contained a review of the *Expert* and *Final* cartridges.

I hope this introduction to using the drive will be of value. I am aware that I haven't touched on using data files, but this in itself is a fairly big subject. I intend to give an introduction to this in a future item – so watch this space!

A Flow of Ideas

When you're all excited about starting your next program, pre-planning may seem dull, but it can save time in the long-run.

By Norman Doyle

Flowcharting had always been anathema to me. I'd read so many holier-than-thou articles about how flowcharts are the only way to produce well-structured programs, that it left me feeling inadequate. I am a programmer, but charts left me cold – only when I analysed my methods did I realise that I'd been doing informal flowcharting for years without realising it.

What happens when you sit down to write a program? First of all you decide what the program is going to do. Then, if you're anything like me, the next thought is whether there's a program that can be modified somewhere in the software collection, or if not, are there any routines that can be 'borrowed' piecemeal?

You may not realise it, but already you've stepped onto the slippery slope to flowcharting. Basically, what's happening is that you're breaking down the job into smaller parts. Take the archetypal *Space Invader* program, and imagine that you've sat down to write it. First you have to analyse what it does.

Immediately you consider the program, certain elements leap out at you. Let's work out how a simple decimal to hexadecimal converter could be written. In making this decision, we've started planning, because the aim of the project has already defined the start and end points of the project.

decimal input
↓
hexadecimal output

To continue, we must now define more clearly what the end result will contain.

For most purposes, hexadecimal numbers are particularly useful when high and low byte values of a number have to be calculated. So why not make this routine convert a number to hex, and print out the hex conversion plus the high and low bytes in hex and decimal.

decimal input
↓
print out
hexadecimal number
high byte dec & hex
low byte dec & hex

Now we know where we're going, we can now consider the program in greater detail.

A number has to be entered for the computer to work on. Rather than converting to hex and then back again, it would seem logical to split the high and low byte at this point. Next, the hex number has to be calculated, and then all of the information can be printed out.

decimal input
↓
split high and low byte
↓
convert to hex values
↓
print out
hexadecimal number
high byte dec & hex
low byte dec & hex

The program is now taking a very definite shape, but the hex calculation is still a little vague. From the rough diagram, it's clear that at this point there are three values floating around: the decimal number and the high and low bytes in decimal. This means that two of the numbers are less than 255, and can be treated in the same way for conversion to hex. The two numbers can then simply be concatenated to yield the full hexadecimal number. This would give all the values necessary for the final printing section.

Since it's necessary to put both the high byte and the low byte through the same process, a subroutine would remove the need for repeating the same program lines twice. A breakdown of this routine is needed.

Each number has to be split further into a high and low nybble. The value of each is then converted into character ready for recombining in the final hex conversion. Once again there's a repeated action and, therefore, another subroutine.

Decimal Input

1: Program
split high and low byte

↓

convert high

↓

byte to hex

↓

convert low byte to hex

↓

print out
concatenated high & low byte
high byte dec & hex
low byte dec & hex

2: Subroutine
split high and low nybble

↓

calculate character for high nybble

↓

calculate character for low nybble

↓

combine high and low nybble

↓

return to main routine

3: Subroutine
add 48 to give character code for number

↓

convert numbers over nine to letter code

↓

return to conversion routine

This is a fairly simple example of an informal flowchart, and in this case it is probably quite sufficient. The proof of the effectiveness of the flowchart comes when the program is written.

Decimal input is simply an INPUT command with a suitable text message:

```
10 INPUT "WHAT IS THE DECIMAL VALUE";NO
```

A simple mathematical calculation splits the high and low bytes:

```
20 HI = INT( NO/256 ):LO = NO - HI * 256
```

Calculating the high byte and the low byte in hex involves the two interactive subroutines. In the case of the call from the main routine, variables are swapped before calling and after returning from the routine.

```
30 TEMP = HI:GOSUB 100:HI$ = TEMP$
40 TEMP = LO:GOSUB 100:LO$ = TEMP$
```

This printing out of the information is simply a case of fitting the correct variables with suitable text:

```
50 PRINT NO;" = $"; HI$; LO$: PRINT "HI-BYTE = "HI, "$"; HI$:PRINT "LO-BYTE = ";LO, "$"; LO$
60 END
```

Amplifying the subroutines, the nybbles have to be calculated and assigned to suitable variables. The values obtained are then converted to character values, and then the characters are stored as a string, which is built up into the hexadecimal byte value before handing back to the main routine.

```
100 T=(TEMP AND 240)/16:GOSUB 150:TEMP$ = CHR$(T)
130 T=TEMP AND 15:GOSUB 150:TEMP$ = TEMP$ + CHR$(T)
140 RETURN
```

The character value calculation which forms the second subroutine merely adds 48 to the numerical value of the nybble. This means that the character value for one to nine is given directly, but the alphabetical values from A to F (values 58 to 62) would actually produce various punctuation symbols if CHR$ was to be applied at this point. These values need to be raised to render values of 65 to 70 which will give CHR$ characters A to F.

```
150 T=T+48: IF T>57 THEN T=T+7
160 RETURN
```

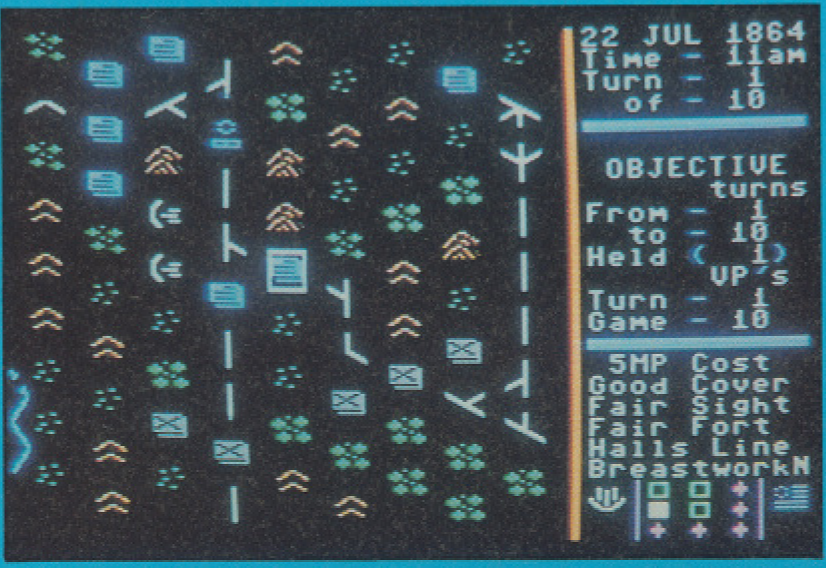
If the program is tested it will actually work. If a problem did arise, it would be easier to locate the seat of the problem thanks to the pre-programming planning stages.

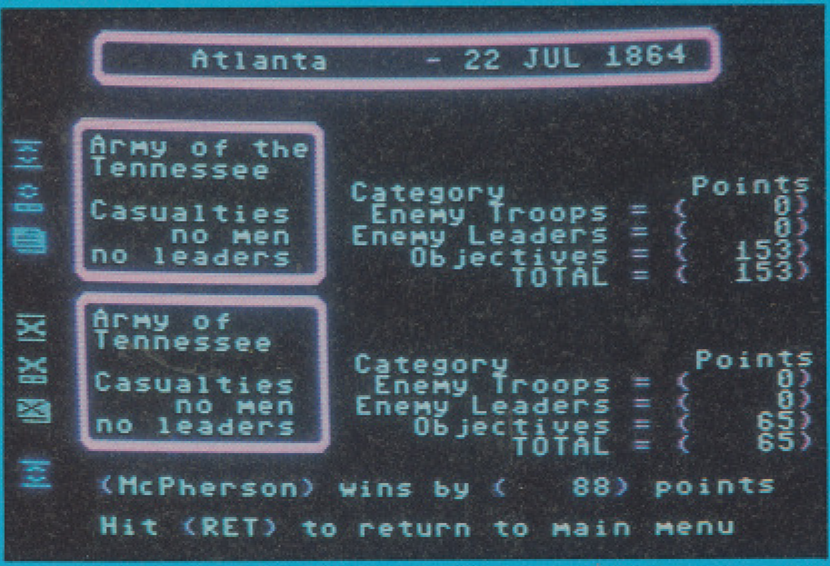
```
PROGRAM: DEC TO HEX CONVERT

12   10 INPUT"NUMBER";NO
27   20 HI=INT(NO/256):LO=NO-HI*2
     56
F4   30 TEMP=HI:GOSUB100:HI$=TEMP
     $
26   40 TEMP=LO:GOSUB100:LO$=TEMP
     $
73   50 PRINTNO" = $";HI$;LO$:PRI
     NT"HI-BYTE = "HI,"$"HI$:PRIN
     T"LO-BYTE = "LO,"$"LO$
2B   60 PRINT"ANOTHER VALUE? (Y/N
     )"
FF   70 GETA$:IFA$<>"Y" AND A$<>"
     N"THEN70
ED   80 IF A$="Y" THEN PRINT:GOTO
     10
DA   90 END
9E   100 TEMP$=""
90   110 THI=(TEMP AND 240)/16:TE
     MP=TEMP AND 15
0A   120 T=THI:GOSUB 150:TEMP$=CH
     R$(T)
3F   130 T=TEMP:GOSUB 150:TEMP$=T
     EMP$+CHR$(T)
02   140 RETURN
B6   150 T=T+48:IFT>57THENT=T+7
2E   160 RETURN
```

Civil War

Decisive Battles of the American Civil War Vol III





The American Civil War has been covered more than any other period in history as far as wargames are concerned. There are two main reasons why this is so. The conflict marks the beginning of modern warfare as we know it, and secondly, it's the only real history Americans have got, and most of the major wargame-producing companies just happen to come from the other side of the pond.

It must come as something of a shock then to the Americans to find their own specialised period being the subject of a wargame from an Australian company. Not only that, but as in the previous games in this series from the Strategic Studies Group, it's much better than anything else currently on the market.

The third (and final) volume in the Civil War series covers six different scenarios all occurring towards the end of the war. If the names of the battles – Wilderness, Spotsylvania, Cold Harbour, Atlanta, Franklin and Nashville – are not too familiar, then the commanders involved – Lee, Grant, Hood, and Sherman – certainly are. Despite Lee winning three tactical victories, he was still powerless to prevent the inexorable advance of Grant's forces, who were able to make much better use of the railways to keep their armies supplied.

Should you grow weary of these six battles, then you can always vary them as you see fit. Included in the package is the Warplan utility, allowing you to alter just about any variable that you choose. Hints are given throughout the documentation as to what changes you might like to try, and there is a worked example showing you exactly how to go about it.

The literature accompanying the game is first-class, and gives a fair indication of the care that has been taken with the program. The 48 page instruction booklet gives the historical background to the scenarios, as well as taking you through all the menus used in the game. Summaries of these menus are included on separate cards, together with a full colour map of the battle areas. Finally, there are even some sticky labels included for you to put on your scenario and saved-game disks.

These games are not the sort that I would recommend to a beginner, but to an experienced player, they should provide many hours of enjoyment. Just think of it, no need to find someone else to play against, no fiddling about setting up of thousands of pieces, hidden movement, saving as many positions as you want and with all the calculations done for you. Wargamers have never had it so good! **G.R.H.**

Touchline:
Title: *Decisive Battles of the American Civil War Volume III.* ***Supplier:*** *Electronic Arts.* ***Price:*** *£18.95.*

Extending Basic

Learn how to develop your own extended Basic routines

By Burghard-Henry Lehmann

Commodore 64's Basic is about as inadequate as you can get. Many commands which other 8-bit home computers take for granted are missing, like CLS (clear the screen), AT (set print position to line x, column y), and GOTO variable, which allows you to define a line number as a variable – to mention but a few.

But worst of all, Commodore Basic does not support any of the advanced graphic and sound features of the C64. If you are an avid programmer in Basic, you might be forgiven for never having come across any of the more advanced features of your computer – unless, that is, you go into heavy poking and write lots of subroutines in machine code.

The purpsose of this series of articles is to show you how you can soup up Commodore Basic in any way you like according to your personal needs. This is *not* yet another series of extended BASIC routines you just type in and use. Instead you should be encouraged to develop your own extended routines – the examples given are meant only as illustrations to help you develop your own ideas.

Since extended Basic routines have to be written in machine code, (they'd be impractical otherwise) you'll need some grounding in assembler programming, as given in my recent *Your Commodore* series. *Byting Into the 6510*. In a way this series is a continuation of Byting Into the 6510 because it should also teach you a lot more about assembler programming, especially about making use of the many ROM-routines of the C64.

Driving a Wedge

In order to make the C64 accept and execute your own extended commands, first you have to intercept the normal flow of Basic at one point in the ROM. This is called "driving a wedge". A wedge is a routine that interrupts the normal flow of a ROM-routine, and makes the computer jump to a routine written by you instead of the normal routine written in ROM.

But how can you drive a wedge if you can't write to ROM? The developers of the C64, who wanted their machine to be as flexible as possible, thought of this. The most important routines both in the Basic-ROM and the Kernal-ROM are accessed via vectors, and these vectors are in RAM, where they can be changed.

A vector points to the start address of a certain routine. Instead of jumping straight to the beginning of the routine, the computer gets the start address for the routine from the vector location (indirect addressing), and then jumps to that address.

The most important vectors of the C64 are at location $0300 to $033B. Since all these vectors are in RAM, they all can be changed! For example, location $0302 normally points at $A483. This is the so-called "BASIC Warm Start", which is entered either after a direct command has been executed or a Basic line has been entered into the Basic textfile.

It starts by waiting for the return key to be pressed. Then the line on the screen is entered into what is called the "input buffer". Next, if the line has no number, it is executed straight away as a direct Basic command or, if it has a line number, the line is entered into the Basic textfile. Then the computer jumps back to the warm start. But every time it goes via the indirect jump in locations $A480, and this indirect jump uses the vector at $0302. If it hasn't been changed, the computer jumps to $A483, the start of the routine. If it has been changed, the computer jumps to whatever routine the $0302 vector is pointing at.

You could therefore intercept the normal Basic flow at this point. But since you want to introduce new Basic commands, there is a better point. We intercept Basic just before a Basic statement is executed by the computer. This is done via the vector at $0308 – normally this vector points at $A7E4.

Executing a Basic command

The routine at $A7E4 starts with the Basic line to be executed being stored in the input buffer ($0200-$02FF). Furthermore, all Basic commands have already been tokenised. This means that, if the first character the computer gets from the input buffer is larger than $80 (decimal 128), the computer knows that it has to be a Basic command. Otherwise it's part of a parameter, that is a number, a variable or a string.

The routine starts by getting that character from the input buffer and evaluating it. For this it uses a very important routine which is written into the zero page at location $73 whenever the computer is started up. This is called "CHARGET" and works like this:

First the pointer which points at the address in the input buffer, where the next character is, is incremented by one. Then the character is fetched from that position and put into the accumulator. Finally the routine does a number of tests which set the zero-flag and the carry-flag according to the nature of the character. If it's a letter, carry is cleared, and if the number is zero, which is always used as an end marker by the computer, the zero-flag is set.

CHARGET is a very clever piece of programming, because every time the routine is used it modifies itself (this is why it is in RAM and not in ROM as most other routines of the operating system). Figure 1 shows the CHARGET routine. It's an excellent example of efficient machine code programming, and because of this worth studying thoroughly.

First the location pointer in $7A is incremented (lines 10-30). Since $7A is at the same time part of CHARGET

Figure 1: CHARGET

```
10   0073  E67A     CHARGET INC $7A       ;bump character pointer (low)
20   0075  D002             BNE NOHIGH    ;if overflow,
30   0077  E67B             INC $7B       ;bump character pointer (high)
40   0079  AD60EA   NOHIGH  LDA $EA61-1   ;fetch char. from modified address
50   007C  C93A             CMP ':        ;if above numerics
60   007E  B00A             BCS EXIT      ;return with C=1 (and Z=1 if ":")
70   0080  C920             CMP $20       ;if character is a space,
80   0082  F0EF             BEQ CHARGET   ;ignore and get next character
90   0084  38               SEC
100  0085  E930             SBC '0        ;if below numerics
110  0087  38               SEC           ;return with C=1 (and Z=1 if $00)
120  0088  E9D0             SBC $D0       ;if numeric, return with C=0
130  008A  60       EXIT    RTS           ;return with flags set and char. in A
```

(namely the operator to the LDA instruction in line 40), it's always automatically updated and the next character loaded into the accumulator.

Notice that CHARGET ignores all spaces (lines 70 and 80). If it comes across a space it simply jumps back to the beginning of the routine. This allows you to use as many spaces in-between Basic statement as you like, or else you can type a direct Basic command at the other end of line which will still be recognized and executed properly.

After the current character has been fetched by the CHARGET routine, the execute-a-statement routine jumps to a subroutine which finds out if it is a BASIC command or not. If yes, that is if the value is larger than $80, the computer jumps with the help of the token code to the appropriate routine, which then executes the command itself. This is done by subtracting $80 or decimal 128 from the token code. The result gives the position in the table of tokenised commands, and this in turn gives the address of the routine where the command is executed. Otherwise the following characters are being dealt with as the parameters of a LET command or, it's a colon, the next character is fetched.

Figure 2 gives you a disassembly of the routine which takes the token code (-128), and makes the computer jump to the right routine. One way of doing this might be by writing a routine like this:

```
LDA tokenvalue-128
CMP      1
BEQ Routine 1
CMP      2
BEQ Routine 2
etc.
```

This is of course a pretty long-winded way of doing it, and the routine uses a lot of memory space. Instead the jump is calculated by first multiplying the token value by two. This is done because every address has a low byte and a high byte.

The doubling up of the value is

Figure 2

```
ASL A            ;get 2* A-128 as index to table
TAY              ;this is the index
LDA $A00C+1,Y    ;move high byte of routine address onto stack
PHA
LDA $A00C,Y      ;move low byte of routine address onto stack
PHA
JMP $0073        ;jump to CHARGET, and from there to routine itself
```

```
           ORG 49152
           ENT
;
CHARGET    EQU $0073
EXECVECT   EQU $0308
;
;
;
;TURN EXTENDED BASIC ON
;BY CHANGING VECTOR AT $0308
;
EXTBASON   LDA #<PRGSTART
           STA <EXECVECT
           LDA #>PRGSTART
           STA >EXECVECT
;
           RTS
;
;
;
;TURN EXTENDED BASIC OFF
;BY CHANGING VECTOR AT $0308
;BACK TO NORMAL ($A7E4)
;
EXTBASOFF LDA #<$A7E4
           STA <EXECVECT
           LDA #>$A7E4
           STA >EXECVECT
;
           RTS
;
;
;
;*** MAIN PROGRAM ENTRY ***
;
;LOOK FOR EXTENDED BASIC COMMANDS
;
PRGSTART   JSR CHARGET
           CMP 'O
           BEQ TURNOFF
;
           CMP 'B
           BNE NORMAL
           JSR CHARGET
           CMP #$B0    ;'OR' TOKEN
           BNE NORMAL
           JSR CHARGET
           CMP 'D
           BNE NORMAL
           JSR CHARGET
           CMP 'E
           BNE NORMAL
           JSR CHARGET
           CMP 'R
           BNE NORMAL
;
;EXECUTE 'BORDER' COMMAND
;
;GET BORDER PARAMETER
;
           JSR CHARGET
           JSR $A96B
;
;CHANGE BORDER COLOUR

           LDX $14
           STX 53280
;
;JUMP TO REST OF ROM-ROUTINE
;
           JMP $A7AE
;
;
;TEST FOR REST OF 'OFF'
;
TURNOFF    JSR CHARGET
           CMP 'F
           BNE NORMAL
           JSR CHARGET
           CMP 'F
           BNE NORMAL
;
;EXECUTE 'OFF' COMMAND
;
           JSR EXTBASOFF
;
;GET NEXT CHARACTER AND
;JUMP TO REST OF ROM-ROUTINE
;
           JSR CHARGET
           JMP $A7AE
;
;
;
;DO NORMAL .OM-ROUTINE
;
NORMAL     JMP $A7E7
```

done in machine code simply by using the ASL instruction, which shifts the bits of the register or memory location one bit to the left. The result is that the overall value of the byte is doubled. Next, this value is transferred into the Y-register, which is then used as the index.

The jump table of Commodore Basic commands starts at $A00C, which is pretty much at the beginning of BASIC ROM. First of all, the two jump address (high and low) bytes must be found by using an indexed load. Then, the high byte of the jump address is pushed onto the stack. Then the low byte of the address is calculated in the same way, and this too is also pushed onto the stack.

Now, this address has been registered as a return address of a subroutine on the machine stack. That is, the next time an RTS instruction is executed, the computer pulls that address automatically from the stack and jumps to it.

The routine ends by jumping to the CHARGET routine in order to get the first character of the possible parameters of the Basic command. Since CHARGET ends with an RTS instruction, the result is that the computer jumps to the command routine itself, because it will pull the address we have just stored on the stack and use it as the return address.

A pretty neat piece of programming, isn't it! You can use this method in several ways in your own programming, for example by using the ASCII-values of the first letters of a table of commands or subroutines.

Main Program

List 1 contains our program, which drives a wedge into ROM before a statement is executed, and executes two Basic commands of our own. First the vector at $0308 is changed so that the computer jumps to our routine instead of the usual one at $A7E4 (lines 120-170). The next routine changes the vector back to normal (lines 250-300). This effectively switches our extended Basic commands off, so that we will get the usual syntax error report should we use them.

Then comes the wedge itself. To start the ball rolling I have chosen two new commands: OFF and BORDER. The first one simply switches extended Basic off, by calling on the routine in lines 250-300. You activate our extended Basic by giving the direct command: SYS 49152, and you switch it off by giving our new command OFF.

The second command, BORDER, lets you change the border colour of the screen with a BASIC command. The syntax is: BORDER n, whereby n is a number between 0 (black) and 15 (light grey). Once you've got the hang of how the routine works, I'm sure you won't have any problems adding two further commands which allow you to change the ink and the paper colour.

Incidentally, these two new Basic commands (as well as the others we'll introduce in future) can be executed as direct commands, as well as included in programs! But if you include them in a program you'll first have to load and activate our extended Basic. Otherwise you will get one syntax error report after the other, because the computer won't recognize any of the new commands.

The idea of our main routine is really very simple: the next character is fetched with the CHARGET routine (line 380), and then compared first with the "O" from OFF and then, if it doesn't match, with the "B" from BORDER. If it doesn't match with that either, the program flow returns back to the normal ROM-routine, which is then executed as if nothing had happened.

If it matches with the "O", then the program jumps forward to lines 760-810. The next character is then fetched and compared with the first F from OFF. If *that* matches, our command OFF has been given; if not, the program jumps to "normal", that is the normal ROM-routine.

Line 850 executes the command OFF itself, simply by calling on the EXTBASOFF routine in lines 250-300. Finally the next character is fetched, and the program jumps back to the ROM-routine at $A7AE. Our command BORDER is being dealt with in a similar way: first the program checks that the command has been given (lines 420-500). If yes, it is executed, otherwise the program returns to normal.

Notice that in line 450, I compare with $B0 instead of comparing with the letter "O", as you might expect. The reason for this is that OR is a command of Commodore Basic and is therefore tokenised into $BO. That is, when the word "BORDER" is put into the input buffer, the "OR" which is contained in it is tokenized into $B0, because at this point the computer has no way of knowing that BORDER is a new command. You have to be aware of this with any new Basic command you give. If the name of the command contains the name of a Commodore Basic command, then that command will be tokenised.

Furthermore, there's one limitation in the new command names you can choose: your new Basic command mustn't start with a Commodore Basic command. If it does, only your command will be executed, but not the Commodore Basic command.

For example a new command PRINTER (to turn on the printer), would disable the normal command PRINT from being executed. There *is* a way to overcome this limitation, but it would be rather complicated and not really worth it, since there are enough words which do not start with a Commodore Basic command.

Getting a Parameter

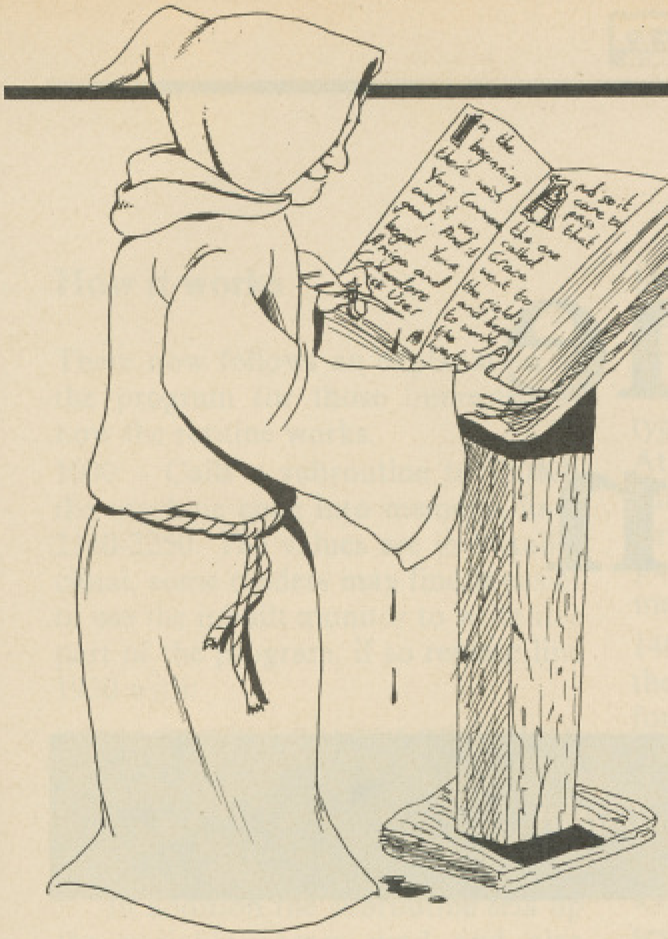
Our BORDER command would not be much good without a parameter which gives the colour code itself – lines 610 and 620 get that parameter. First the next character is fetched into the accumulator with CHARGET. Then we call a ROM-routine, which gets a series of ASCII numerical characters and converts them into low byte/high byte binary-decimal. The result is stored in the system variables $14 (low) and $15 high.

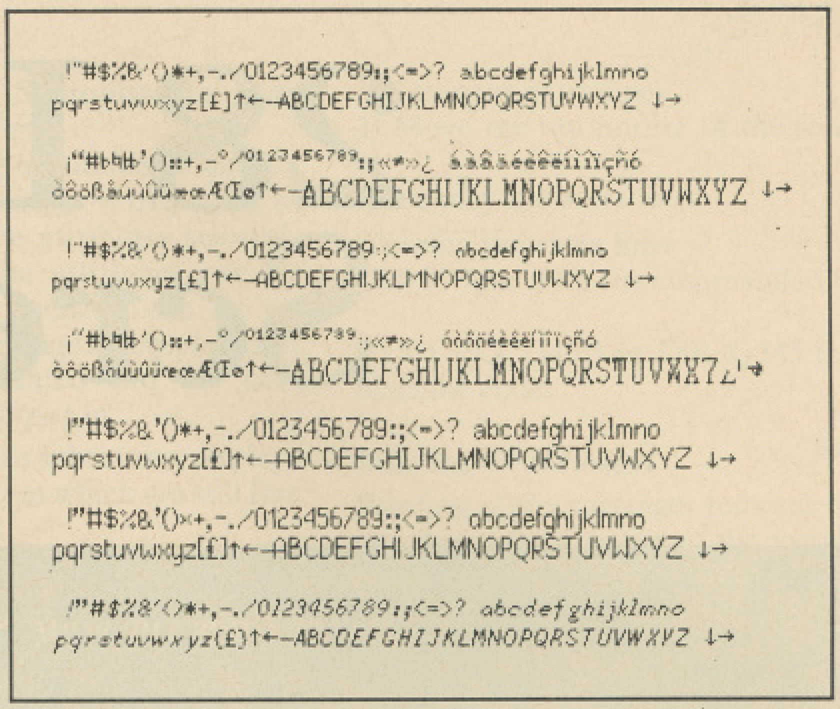
This routine has been designed to convert the line numbers from their ASCII-form into binary-decimal as they appear on screen. It can only deal with integers in the range from 00-63999. In line 660 I get the low byte from $14 (of course the high byte in $15 is of no interest in this case to us) and load it into the location 53280, which changes the border colour.

Notice that I use the X-register for this, and not the accumulator. This is because I want to keep the character in the accumulator, since I'll need it for when I return to the ROM-routine at $A7AE.

Finally

When you try out the BORDER command, you will notice that it doesn't work with variables. In the next article we will overcome this limitation and introduce a COLOUR command which will change border, paper and ink colour all in one go.





Professional Print quality on a Plus/4? Paul Eves takes a look at YER's latest utility.

Print Enhancer

In these days of the Amiga, C128 and C64, it is a refreshing change to see that someone has not forgotten the poor old +4. Print Enhancer, from York Electronic Research, is an excellent +4 program, used primarily with the MPS801 and 1525 printers. Unlike the Printer IV Rom chip which I reviewed last year, this program is software dependent. This has obvious disadvantages, mainly speed of use and accessibility. But the advantages outweigh these. For example, fonts can be changed midway through a line, and the user can design their own fonts. Other options are also available. So what exactly is Print Enhancer? Basically, the program enables you to produce impressive letters and documents with true descenders. You can use custom-designed fonts, or select from a choice of 15 inbuilt ones. The program supports proportional spacing, underlining, superscripting and subscripting. The program may be used in one of three ways: with the 3+1 inbuilt word processor, the Script+ cartridge or through a Basic program.

Once the program is loaded and running, there are four fonts of 96 characters resident in memory. These fonts are in four separate banks, which can be switched in and out at will using special codes. More fonts may be loaded in as and when required. This aspect of the flexibility of the program is what in my opinion makes this program stand out. It means that you are no longer restricted to just one typeface. Thus, your documents or letters take on a more professional aspect. A selection of the special codes are shown below. Each code is preceeded by a command character, and these command characters vary from 3+1, Script plus and basic. The command characters are CHR$(222), Escape CHR$(27) and CHR$(27) respectively.

0 – Selects character set bank 0
1 – Selects character set bank 1
2 – Selects character set bank 2
3 – Selects character set bank 3
(These commands should be used within, or at the end of a line)
4 – Turns on/off underlining
5 – Turns on/off justification
6 – Loads named character set (Wildcards may be used)
7 – Set single line spacing
8 – Sets one and a half line spacing
9 – Sets double line spacing
(Commands 5 – 9 should be on a line of their own)

Therefore the statement: PRINT #1,CHR$(27) "6italic"
PRINT #1,CHR$(27) "3"
would load the file named italic into bank 3.

Although to get the full benefit of Print Enhancer a few special commands need to be learnt. Thankfully though, YER have made these as few as possible. Therefore I feel that once you have used the program a couple of times, you will know all you need, without having to constantly look up the manual.

Finally, we come to the font designer. Like the rest of the program, the designer is straightforward to use, with only a few keys to remember. Once you have designed your own font(s), these are saved for use later. You may then mix your own fonts with those supplied.

The keys used within the designer are as follows:-

Escape to get into edit mode. + and – for setting or erasing points. Space bar for selecting a character to edit. The Fkeys 1 through 6.

All in all I was impressed with this program. Good +4 utility programs are hard to find these days. Above are a couple of examples of Print Enhancer's capabilities.

28 Line Screen

Extra lines on your 80 column display

By D J Lines

A number of applications use status lines to update the user, telling him/her to carry out a particular action. There are times when you would like to include this type of message in your own programs. To do this you could set aside the top or bottom lines of the screen (by using interrupts), use multiple screens or a string of control codes to place your message on the screen. The window facility of the C128 could also be used. However, these techniques have their disadvantages. Normally a status line is just that, a line! Using separate screens to inform the user to insert a disk into the drive seems rather wasteful. The other methods involve overwriting existing text or reducing the number of lines on the screen.

The 80 column video chip offers another solution.

Register number six of the VDC contains the number of lines that are to be represented on the screen, and changing this number allows more than the normal 25 lines to be shown (or less than 25 for that matter). The number of lines displayed is dependent on the quality of the monitor used. I use a Commodore 1900M green screen monitor and I found that I can display up to five extra lines without any problems.

The program presented here allows you to type in up to 25 messages of one, two or three lines (ie. 80, 160 or 240 characters in length) that you can then print to the extra lines on the screen with ease from within your own programs.

Getting it in

The Basic program presented here produces a machine code routine made up of three parts, a routine for writing the messages, a table of pointers and thirdly the messages themselves, stored as upper/lower case. This is all stored from $1300 to $1BFF and once assembled it can be called from either Basic or machine code.

The machine code routine for writing to the VDC is stored from $1300 to $13BC. Immediately after this there are 100 bytes set aside for pointers. Each message requires four pointers, two for the address of the message and one byte each for the length and the attributes (colour flashing etc.). This leaves just over 2000 bytes free for the text.

Accessing the VDC

The base address for the VDC is located at $D600 and it has a total of 37 registers. Unfortunately the VDC cannot be accessed in the same way as the VIC or SID chips, that is, the various registers can't be POKEd or PEEKed directly. All communication between the outside world and the VDC chip must take place through two registers at $D600 and SD601. As a result though, any program that uses the VDC is by necessity fairly complicated.

When writing to a register in the VDC, the register number is placed in $D600 and the new value for the register is placed in $D601. If you wish to read the value of a register, the number of the register is placed in $D600 and the VDC returns the value in $D601. The registers that this program uses are:

Reg 6 Number of lines displayed.
Reg 7 The upper border of the screen.
Reg 18 Hi byte of address in VDC to be manipulated.
Reg 19 low byte of Reg 18
Reg 20 Hi byte of the start address of attribute memory.
Reg 30 Number of characters to be written to address pointed to in Reg 18 and 19.
Reg 31 Data, the actual character codes are written here.

How it works

There now follows an explanation of the program for those interested in how the routine works.

1000 – Calls a subroutine to POKE the machine code into memory, lines 2140-2250. The values are in hexadecimal, some readers may find it easier to use the inbuilt monitor to write this part of the program, if so replace line 1930 with:

```
1930FAST:COLOR6,1:COLOR5,2:WINDOW0,0,79,24,1:PRINTCHR$(14),CHR$(11)
```

and omit line 1940.

In addition the subroutine sets up the variable names used and also allows you to pick from one, two or three extra lines in the display.

Note there is a KERNAL routine to reset the VDC located at $E1DC but this does not reset all the registers to their default values. I found it necessary to use the IOINIT routine at $E109, unfortunately SID is also reset and silenced!! CHR$(7) is the 'bell' and printing this gets SID feeling like himself again.

Memory location $A2F in zero page contains a pointer for the VDC attribute RAM and normally contains and eight.

Once the machine code has been read and the screen is set up the extra lines appear at the bottom of the screen filled with reverse stars.

1010 to 1080 – Control loop calling various subroutines. The loop termnates when 25 messages have been entered or there is no space left. An exit is also forced if "*q" is typed in.

1160 to 1310 – Subroutine to input the message string. All alphanumeric characters are accepted ie. UPPER and lower case.

When editing your message only the delete key can be used, cursor keys, HOME, CLR etc. will not operate. The subroutine will terminate when RETURN is pressed or the number of characters exceeds the limit for the screen.

1240 to 1400 – Subroutine to select the attribute values. This routine allows you to select the colour of the message, whether it flashes, is underlined or printed in reverse.

1480 to 1480 – Subroutine to write message to memory.

1510 to 1610 – Subroutine to display message. The message is displayed as typed in with the attributes selected. At this point the attributes can be changed or the message can be rewritten. If the message is accepted then pointers are updated and the next message can be typed in.

1460 to 1790 – This subroutine displays the number of bytes which are still free for you to use.

1820 to 1830 – Subroutine for audio warnings.

1860 to 1900 – Subroutine for single key press. Used for Yes/No answers ky$(l) and ky$(2) are the keys to be tested ie. "y" and "n" (or any other two keys.). Once all of the messages have been typed in or you run out of space, the machine code, pointers and messages are SAVEd on disk. The program is SAVEd as *MESSAGES* and overwrites any other program with this name. You can of course change this program to any name that you wish.

Machine code program

Once compiled, the machine code program has three main entry points. One to set up the screen, one to clear the extra lines and the routine to print the messages. Details on the three routines follow:

Setting up the screen
This is done by entering:

SYS DEC("13B0") or JSR $13B0 from machine code.

the routine carries out the following:

1) Moves the attribute memory of the VDC from $0800 to $1000.
If you look at the memory map of the VDC you can see how this is possible.

$0000 – $07FF Screen RAM
$0800 – $0FFF Colour/attribute RAM
$1000 - $1FFF Free RAM
$2000 - $3FFF Character generator.

As you can see there is 4K of memory available to the user without interfering with the character sets.

2) Clear the extra lines
3) Move the top border of the screen up
4) Display the extra lines

Clearing the extra lines
This is done with the command:

SYS DEC("1345") or JSR $1345 from machine code.

Printing the messages
Printing of the messages requires that you know the number of the message that you want to print. The syntax for this command is:

SYS DEC("1360"),N

where N is the message number (0-24).

If calling the routine from machine code you must load the accumulator with the message number before the call ie.

LDA ; message number
JSR $1360 ; Call routine.

Note: Messages are numbered from 0 to 24 NOT 1 to 25.

On your own

Even though the program may at first sight seem a little complicated to use you should get used to it after playing around with it a few times. Using this routine will help to give your C128 programs a professional quality that is only usually seen in commercial programs.

PROGRAM: 28 LINE SCREEN

```
1000 GOSUB1930                    : REM
**** READ MACHINE CODE DATA ****
1010 DO UNTIL PM - 0 OR SP - 0
1020 GOSUB1160                    : REM
**** INPUT STRING ROUTINE      ****
1030 IF IN$-"*Q" THEN EXIT
1040 GOSUB1340                    : REM
**** SET ATTRIBUTES ROUTINE ****
1050 GOSUB1430                    : REM
**** WRITE STRING TO MEMORY ****
1060 GOSUB1510                    : REM
**** ACCEPT MESSAGE ?          ****
1070 GOSUB1640                    : REM
**** DISPLAY SPACE LEFT        ****
1080 LOOP
1090 GOSUB1740                    : REM
**** SAVE TO DISK              ****
```

```
1100 STOP
1110 :
1120 :
1130 WINDOW 0,0,79,1,1 : PRINTSP
C((80-LEN(MSG$))/2) CHR$(18) MSG
$; : WINDOW 0,3
,79,24 : RETURN
1140 :
1150 :
1160 MSG$=" [s I]NPUT STRING NU
MBER "+STR$(SN)+" OR TYPE '*
Q' TO FINISH."
:GOSUB1130: IN$= "" : WINDOW
0,6,79,10,1 : PRINTCHR$(18)CHR$
(32)CHR$(19);
1170 DO
1180 KY$="" : DO WHILE KY$="" :
GET KY$ : LOOP
1190 IF KY$=CHR$(20) THEN BEGIN
1200 IF LEN (IN$) > 0 THEN IN$ =
MID$( IN$,1,LEN(IN$)-1) : PRINT
 KY$ ;: ELSE : G
OSUB 1820
1210 BEND
1220 IF KY$=CHR$(13)THEN EXIT
1230 IF LEN(IN$) >= TEXTL THEN E
XIT
1240 IF ( ASC(KY$) >31 AND ASC (
KY$) <127) OR (ASC (KY$) > 160)
THEN BEGIN
1250 IN$ = IN$ + KY$ : PRINTKY$
;:
1260 BEND
1270 LOOP
1280 IF SP-LEN(IN$) < 0 THEN BEG
IN : MSG$="[s F]ATAL ERROR !!! [
s T]HERE IS NOT
ENOUGH ROOM LEFT !!!":GOSUB1130:
FORY=1TO5:GOSUB1820:NEXT:IN$=LEF
T$(IN$,SP)
1290 SLEEP2:MSG$="[s T]HE LAST M
ESSAGE HAS BEEN TRUNCATED. [s T]
HERE ARE ONLY "
+STR$(SP)+ " BYTES FREE !!":GOSU
B1130
1300 BEND
1310 RETURN
1320 :
1330 :
1340 WINDOW 12,12,35,17,1:K$(1)=
"Y":K$(2)="N":PRINT:INPUT"[s C]O
LOUR CODE (0-15)
";CC$
1350 PRINT"[s F]LASHING  (Y/N) ?
";:GOSUB1860:PRINTKY$:IF KY$="Y"
 THEN FL=16:ELSE
:FL=0
1360 PRINT"[s U]NDERLINE (Y/N) ?
";:GOSUB1860:PRINTKY$:IF KY$="Y"
 THEN UL=32:ELSE
:UL=0
1370 PRINT"[s R]EVERSE  (Y/N) ?
";:GOSUB1860:PRINTKY$ : IF KY$="
Y" THEN RV=64 :E
LSE:RV=0
1380 ATR = VAL(CC$)+FL+UL+RV+128
1390 WINDOW12,12,35,17,1
1400 RETURN
1410 :
1420 :
1430 MSG$="[s W]RITING STRING NU
MBER"+STR$(SN)+" TO MEMORY PLEAS
E WAIT..":GOSUB1
130
1440 POKE PNTRS,LEN(IN$) : POKE
PNTRS+1,ATR : POKE PNTRS+2, MESS
AGES AND 255 : P
```

```
OKE PNTRS + 3 , INT(MESSAGES/256
)
1450 FORX=1TOLEN(IN$):IN = ASC(M
ID$(IN$,X,1)) : IF (IN >63 AND I
N <127) THEN IN
= IN -64
1460 IF IN >192  THEN IN = IN -
128
1470 POKE MESSAGES +(X-1),IN: NE
XT
1480 RETURN
1490 :
1500 :
1510 DO
1520 MSG$="[s P]RESS 'Y' TO ACCE
PT MESSAGE OR 'N' TO CHANGE":GOS
UB1130 :GOSUB183
0
1530 SYSDEC("1360"),SN
1540 GOSUB1860
1550 IF KY$="Y" THEN SN=SN+1 : M
ESSAGES=MESSAGES+LEN(IN$): PNTRS
=PNTRS+4 : EXIT
1560 MSG$="[s P]RESS 'A' TO CHAN
GE ATTRIBUTES OR 'R' TO RETYPE M
ESSAGE" :GOSUB11
30:GOSUB1830
1570 K$(1)="A":K$(2)="R":GOSUB18
60
1580 IF KY$="R" THEN EXIT
1590 GOSUB1340 : POKE PNTRS+1,AT
R
1600 LOOP
1610 RETURN
1620 :
1630 :
1640 WINDOW12,12,72,17,1
1650 PM = ((DEC("1421")-PNTRS)/4
) : SP = DEC ("1BFF") - MESSAGES
1660 IF PM <> 0 AND SP-LEN(IN$)
 > 0  THEN BEGIN : PRINTCHR$(18
)" [s P]OSSIBLE
NUMBER OF MESSAGES LEFT = " PM C
HR$(157)" "
1670 PRINT:PRINT CHR$(18)" [s N]
UMBER OF BYTES FREE
=" SP CHR$(157)
" "
1680 MSG$=CHR$(15)+"[s P]RESS AN
Y KEY TO CONTINUE."+CHR$(143)
:GOSUB1130
1690 GETKEY KY$ :BEND
1700 WINDOW12,12,72,17,1
1710 RETURN
1720 :
1730 :
1740 WINDOW 0,0,79,24,1
1750 PRINT:PRINT"[s I]NSERT DISK
 AND PRESS ANY KEY WHEN READY":G
ETKEY KY$
1760 PRINT:PRINT"[s S]AVING [s M
]ACHINE [s C]ODE AND [s M]ESSAGE
S"
1770 BSAVE"@MESSAGES",D0,U8,B0,P
 4864 TO P (MESSAGES)
1780 PRINT:PRINT"[s F]INISHED !!
"
1790 RETURN
1800 :
1810 :
1820 SOUND3,3000,20,1,1000, 300,
2:RETURN
1830 SOUND3,5000,20:RETURN
1840 :
1850 :
1860 KY$="": DO UNTIL KY$=K$(1)
OR  KY$=K$(2)
```

```
1870 GETKEY KY$
1880 IF KY$<>K$(1) AND KY$<>K$(2
)  THEN GOSUB 1820
1890 LOOP
1900 RETURN
1910 :
1920 :
1930 FAST:COLOR6,1 :COLOR5,2:WIN
DOW 0,0,79,24,1:PRINTCHR$(14),CH
R$(11):PRINT" [s
 R]EADING DATA. [s P]LEASE WAIT.
...."
1940 RESTORE 2140 : BASE = DEC (
"1300") : FOR X = BASE TO BASE+1
88 : READ A$: PO
KEX,DEC(A$) : NEXT
1950 PNTRS = DEC ("13BD") : MESS
AGES = DEC ("1421"):SN=0 : PM =
25  : SP = DEC("
1BFF") - MESAGES
1960 DO UNTIL IN$="Y"
1970 PRINTCHR$(147):PRINT"  [s H
]OW MANY EXTRA LINES (1-3) "
1980 DO UNTIL VAL(KY$) >0 AND VA
L(KY$) <4
1990 GETKEY KY$
2000 LOOP
2010 TEXTL = VAL(KY$)*80
2020 PRINT:PRINT"  [s P]LEASE WA
IT."
2030 FOR X = 1 TO TEXTL  : POKE
MESSAGES + X - 1 , 42 : NEXT
2040 POKEDEC("131F"),25+(TEXTL/8
0):POKEDEC("1340"),TEXTL-1:POKED
EC("135B"),TEXTL
-1
2050 POKE PNTRS , 240 : POKE PNT
RS+1 , 111 : POKE PNTRS + 2 ,DEC
("21") : POKE PN
TRS + 3 ,DEC("14") : SYS DEC ("1
3B0") : SYS DEC ("1360"),SN
2060 PRINTCHR$(147):PRINT"  [s I
]S THAT ALRIGHT ?"
2070 GETKEY IN$
2080 IF IN$<>"Y" THEN POKE DEC("
A2F"),8:SYSDEC("E109"):KY$="":IN
$="":PRINTCHR$(7
)
2090 PRINTCHR$(147)
2100 LOOP
2110 RETURN
2120 :
2130 :
2140 DATA 8E,00,D6,2C,00,D6,10,F
B,8D,01,D6,2C,00,D6,10,FB
2150 DATA 60,A2,14,A9,10,8D,2F,0
A,20,00,13,60,A2,06,A9,1C
2160 DATA 20,00,13,E8,A9,21,20,0
0,13,60,A2,13,A9,D0,20,00
2170 DATA 13,CA,A9,17,20,00,13,A
2,1F,A5,4E,20,00,13,CA,A9
2180 DATA EF,20,00,13,60,A2,13,A
9,D0,20,00,13,CA,A9,07,20
2190 DATA 00,13,A2,1F,A9,20,20,0
0,13,CA,A9,EF,20,00,13,60
2200 DATA 0A,0A,AA,BD,BD,13,85,F
E,E8,BD,BD,13,85,4E,E8,BD
2210 DATA BD,13,85,FC,E8,BD,BD,1
3,85,FD,A9,D0,85,FA,A9,07
2220 DATA 85,FB,20,45,13,A0,00,A
2,13,A5,FA,20,00,13,CA,A5
2230 DATA FB,20,00,13,A2,1F,B1,F
C,20,00,13,A2,12,EA,20,00
2240 DATA 13,E6,FA,D0,02,E6,FB,C
8,C4,FE,D0,DB,20,2A,13,60
2250 DATA 20,11,13,20,45,13,20,2
A,13,20,1C,13,60
```

PLAYING THE GAME

A super fruit machine simulator

by R. Jaycocks

When the game is executed by running the basic line or typing SYS4109, instructions will appear on the screen. After pressing an key the scoring table is printed up. At the beginning of the game ie. after the instructions etc. the timer will be printed in the top left hand corner, this will show you how much time is left. To spin the reels you must have some plays in the plays counter, this is achieved by pressing key 'I' which can only be activated if you have some money left. After inserting the money you may get a hold. This is shown by the hold keys going a lighter red and the cancel key going a lighter green. Pressing keys '1', '2', or '3' will hold the desired reels. If you hold the wrong reel pressing 'C' will cancel the holds allowing you to rehold the desired reels. Pressing 'S' will spin the reels. If you get a win you can gamble the winnings up to 200. Pressing 'C' will gamble the winnings while pressing 'S' will collect the winnings. You may get a nudge and this is detected by a clear 'white' noise and the nugde panel showing random nudges. Pressing 'N' will stop the nugde panel to the current nudge. You may now bring the reels up or down until the number of nudges has decreased to zero. Pressing the shift button with keys '1', '2' or '3' will bring the desired reel up while pressing keys '1', '2' or '3' will bring the desired reel down.

After you have typed in listing one type listing 2 in the correct location making no errors as this is the check program.

Now type in the following line.
G 0600 03 1000 390F to print the checksums to screen or,
G 0600 04 1000 390F to print the checksums to printer device number four.

If any of the checksums do not correspond to the ones in table 1 then recheck the corresponding piece of memory. Once everything is O.K type S'FRUIT MACHINE',8,1001,3910 and press return.

SUMMARY

Keys '1', '2' or '3' operates reels 1,2 or 3 respectively.
Key 'N' is for selecting the nudge.
Key 'S' is to spin the reels or collect the winnings.
Key 'C' is for cancel or gamble.
Key 'I' is for insert.

GETTING IT IN

Go into monitor and type in the following:

F 1000 4000 00
Then type in listing 1

Note. Holding all three wheels will cause a delay of approximately one and a half seconds. This time delay can be altered by poking the desired delay in location \$137A. 0 is the slowest delay while 1 is the fastest. The delays are in one fiftieth of a second. ie: a delay of 100 is 2 seconds.

An alarm will sound once the timer as decreased to 30 seconds, therefore indicating that you have very little time left.

TABLE 1

1000	D1	1050	85	10A0	3A	10F0	EF	1140	D8	1190	A0	11E0	8C
1230	E4	1280	ED	12D0	D2	1320	61	1370	5C	13C0	9C	1410	C8
1460	08	14B0	0D	1500	EC	1550	29	15AO	64	15FO	75	1640	5D
1690	CB	16EO	65	1730	E8	1780	83	17D0	60	1820	00	1870	FA
18CO	79	1910	64	1960	E4	19B0	C9	1A00	3A	1A50	OA	1AA0	F6
1AF0	C8	1B40	EE	1B90	EA	1BE0	36	1C30	51	1C80	47	1CD0	AO
1D20	68	1D70	36	1DC0	C3	1E10	84	1E60	43	1EB0	CE	1F00	D2
1F50	55	1FA0	43	1FF0	14	2040	8E	2090	25	20E0	95	2130	A5
2180	4D	21D0	4E	2220	1D	2270	C6	22C0	93	2310	5B	2360	C5
23B0	58	2400	ED	2450	6B	24A0	D8	24FO	14	2540	4E	2590	26
25E0	72	2630	56	2680	A6	26D0	F6	2720	47	2770	97	27C0	21
2810	18	2860	AB	28B0	B5	2900	81	2950	B5	29A0	E6	29FO	1D
2A40	5B	2A90	CF	2AE0	88	2B30	4D	2B80	AA	2BD0	7F	2C20	E6
2C70	33	2CC0	46	2D10	CD	2D60	87	2DB0	14	2E00	AA	2E50	9C
2EA0	FA	2EF0	EB	2F40	67	2F90	E1	2FE0	F7	3030	A0	3080	D0
30D0	D3	3120	B4	3170	9E	31C0	5D	3210	B1	3260	52	32B0	E5
3300	A3	3350	E1	33A0	13	33F0	97	3440	2A	3490	44	34E0	1D
3530	DD	3580	89	35D0	EA	3620	5A	3670	1F	36C0	12	3710	2F
2760	97	27B0	E7	3800	57	3850	F0	38A0	F8	38F0	78		

Routine Programming

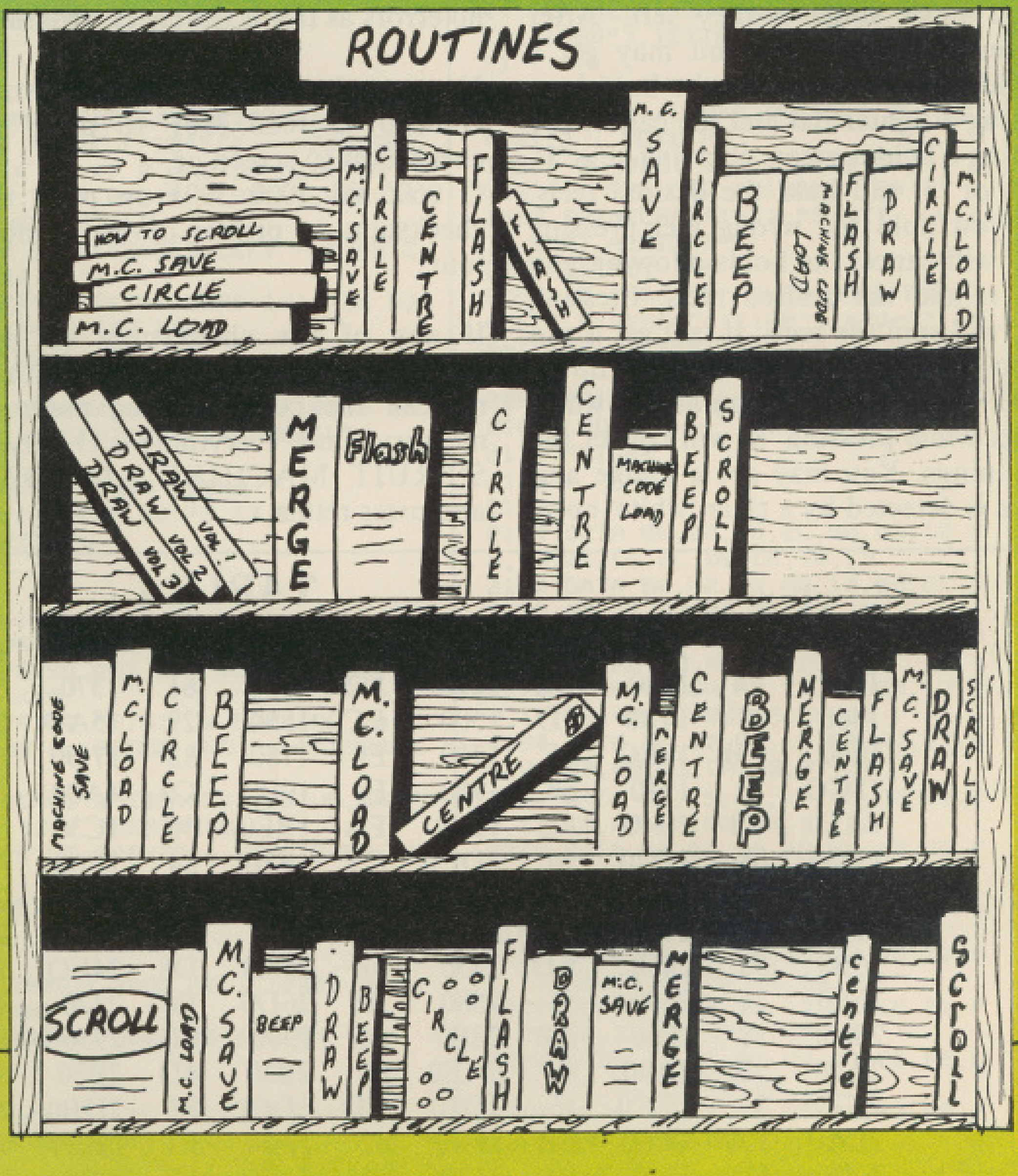
Building a program from a subroutine library can save time, but a way is needed to get them in

By Eric Doyle

Programming has more to do with wrestling than you may at first think. Basic can do a lot of things, but it takes a lot of work to get the wretched machine to do what you want. Dreams of sprites zipping across the screen to full three part harmony accompaniment soon gives way to hours of head banging and table thumping as you grapple towards three falls or a submission against a tough opponent.

Treating each project as a new opponent sets up the correct mental attitude. The ground rules are always the same but the challenge lies in the variety of ways that they can be applied. Before starting, weigh up the style of the program and decide which routines may be useful. With this in mind, it's always a good idea to build up a library of subroutines which can be introduced into a new bout of programming. These are rather like the a professional wrestler's specialist moves, which can be called upon to get a firm grip on the situation.

If a library of routines could be built up, they could then be pulled into the computer from tape or disk to suit the requirements of the program. In an ideal situation, the routines would be merged into memory, renumbered and then the variables changed to suit their new environment. The problem is that the C64 lacks any merge, renumber or change commands, which does inhibit such a grandiose plan. Fortunately, it is possible to merge programs, but only if the Commodore filing system is altered.



The two principal file systems are program and sequential. A program file is the normal file produced using the SAVE command. Sequential files are more complex and, thankfully, unnecessary for the subroutine loader.

Good Intentions

The idea is to create subroutines which can be appended to a program. With

```
PROGRAM: SUBROUTINE LOADER

02   0 PRINT"[CLR,DOWN] [RVSON]R[
     RVSOFF]UN PROGRAM OR [RVSON]
     L[RVSOFF]OAD SUBROUTINE?"
91   1 GETA$:IFA$<>"R"ANDA$<>"L"A
     NDA$<>"[SR]"AND A$<>"[SL]"TH
     EN1
C9   2 FORA=0TO15:POKE56256+A,6:N
     EXT:IFA$="R"ORA$="[SR]"THEN9

E0   3 INPUT"SUBROUTINE FILENAME"
     ;N$:L=LEN(N$):IFN$=CHR$(13)O
     RL=0THENEND
23   4 FORA=1TOL:POKE1983+A,ASC(M
     ID$(N$,A,1)):NEXT:POKE186,8:
     REM POKE186,1 FOR TAPE
5F   5 POKE183,L:POKE184,1:POKE18
     5,0:IFPEEK(186)=1ANDN$="*"TH
     ENPOKE183,0
8A   6 POKE187,192:POKE188,7:POKE
     195,PEEK(45)-2:POKE196,PEEK(
     46):POKE147,0:SYS62631
53   7 IFST=64ORST=0THENSYS42291:
     POKE45,PEEK(174):POKE46,PEEK
     (175)
88   8 END
36   9 CLR:PRINT"[CLR]";
```

no renumbering routine available, it will be necessary to ensure that the line numbers aren't duplicated in the program or confusion will result.

The maximum value for a line number is 63999, so it is best to start numbering subroutine lines from 60000. Each of these mini-programs should rarely need modification, but allowing a gap of three line numbers between each program line should leave room for any future changes or variations.

Another convention that must be adhered to is standardisation of variables. It would be pointless to have a vast library of routines if it meant that a series of variable swapping had to take place every time a GOSUB statement was executed. For example, sound routines always access the SID chip and graphics always use the VIC chip, so setting up base variables of VIC=53248 and SID=54272 would make a good start.

A subroutine library is much easier to use from disk, but cassette based systems can be set up if careful note is taken of the value of the tape counter for each subroutine.

The final problem is one of appending the subroutine onto the program. To make this as easy as possible, a short subroutine loading program needs to be loaded before programming starts. This occupies the first ten program lines, and the new program should always start at a line value from 10 upwards.

How It Works

Lines 0 and 1 allow the programmer to decide whether a subroutine is going to be loaded or if the program is to be tested. It uses the GET statement so only a single keypress will be needed. To indicate which keys are valid, the first letter of each word is highlighted.

```
0 PRINT"[CLR,DOWN]
[RVSON]R[RVSOFF]UN
PROGRAM OR
[RVSON]L[RVSOFF]OAD
SUBROUTINE?"
1GETA$:IFA$<>"R"ANDA$<
>"L"ANDA$<>"[SL]"ANDA$
<>"[SR]"THEN 2
```

With such an input, never assume that the user will press the unshifted key. As you can see from line 1, the program uses the logical operator, AND, to test which of the four possible characters has been entered and if none of these are pressed the line loops back to get another keypress.

By the time line 2 is executed, A$ will contain one of four possible characters, but initially the first 16 locations on the screen are given a foreground colour of blue. The reason for this will become clear later. When A$ is tested, the program jumps to line 9 if the character is 'R' or a shifted 'R' and this is why the actual program should start at line 10 or higher. Line 9 clears the screen and the variables that have been used so that the real program starts off without any declared variables which could otherwise affect the way it runs.

```
2FORA=0TO15:POKE55295+
A,6:NEXT:IFA$="R"ORA$=
"[SR]"THEN9
9 CLR:?"[CLR]"
```

If neither 'R' key is detected, the program safely assumes that one of the 'L' keys was pressed and the subroutine loader asks for a filename. Pressing the return key without typing anything in, a null string entry, is treated as an abort request. This is included in case the loader is entered accidentally. Cassette users who wish to load a program without entering a name should enter an asterisk at the filename input prompt.

```
3 INPUT"SUBROUTINE
FILENAME";N$: L =
LEN(N$) : IF N$ =
CHR$(13)ORL=0THENEND
```

Line 4 stores the filename one character at a time at the top right hand corner of the screen. This is the area whose foreground colour was changed in line 2. Because the foreground now matches the background, these letters are invisible.

```
4FORA=1TOL:POKE1023+A,
ASC(MID$(N$,A,1)):NEXT
:POKE186,8:REM POKE
186,1 FOR TAPE
```

Location 186 is poked with the device number 1 or 8 depending on whether tape or disk is being used.

Relocated Load

The following lines set up the necessary parameters for a relocated load. First, the filename information is stored by placing the filename length in 183. Secondly, the high byte of the filename location is stored in location 188 and the low byte in 189. These values are calculated from the position of the first letter of the filename, 1024 in this case, and, to find the high byte, this number is divided by 256 to give 4 and the remainder is the low byte. In this case there is no remainder so the low byte is zero.

```
5POKE183,L:POKE187,0:P
OKE188,4:IFPEEK(186)=1
ANDN$="*"THENPOKE183,0
```

The if statement checks to see if an unnamed tape file is going to be loaded. If this is true, the filename length is reset to zero.

Location 184 holds the file number and 185, the secondary address, is set to zero to denote a relocated load. The computer needs to know the address of the relocated position. Obviously, the subroutine is going to be added to the end of the program in memory, and the end location is stored in locations 45 and 46, low byte first and then high byte. The low byte is actually two locations beyond the required load position, hence the –2 in the equation. The values obtained by peeking into these locations are then poked into 195 and 196.

```
6POKE184,1:POKE185,0:P
OKE195,PEEK(45)-2 :
POKE 196, PEEK(46)
:POKE147,0:SYS62631
```

Before loading can commence, the value of zero is poked into 147 to indicate a load rather than a verify action. Calling SYS62631 executes the load but bypasses some of the instructions which would upset the values that have just been set.

Just in case the file doesn't exist, a check on variable ST reveals a disk load fault if the value is not 64. A similar check cannot be made on tape loads so an ST value of zero is also permitted.

```
7IFST=64ORST=0THENSYS4
2291:POKE45,PEEK(174):
POKE46,(PEEK(175)
8 END
```

When the ST check is successful, the program jumps to a ROM routine which does some internal housekeeping on the program lines to make sure that they all latch together properly. Now that the program has been lengthened, locations 45 and 46 need to be updated. The end-of-load address is stored in 174 and 175 so the peeked value from these is stored into 45 and 46.

After this all that is left is an end command to make sure that the loader program doesn't run on to execute the program under construction.

Words of Caution

When a cassette load is terminated by pressing the stop key, part of the program will have been loaded and will appear when the program is listed. At this point the end of program pointers will not have been reset, so a new subroutine can be safely loaded. It is better not to abort a load and when it finishes, the unwanted lines can be deleted.

Disk users will experience problems if using a colon in the load command. This will result in an EXTRA IGNORED? message appearing on the screen. To overcome this, type the filename in after an opening quote mark (shift plus the 2 key).

Owners of fast-load cartridges may find that the loader only works at normal speed because the program jumps into the ROM and avoids the load vector at 816/7. In some cases the fast load can be accessed by substituting POKE780,0 for POKE147,0 in line 6 and changing the SYS command to SYS62626. I developed the routine using Dolphin DOS and no changes are necessary to access the fast loader in this case.

As a final tip, keep the program name down to ten characters so that the starting line number can be included. For example, an input routine could be called "KEYPRESS .60000"

Now all that is needed is a series of subroutines so get working and maybe send in any of which you are particularly proud. We can't offer you fortune but a certain amount of fame will be afforded through the pages of *Your Commodore*.

Program Breakdown

Lines	Action
0-1	Choose between loading a subroutine or running the program
2	Change first line foreground to dark blue. Check for program execute
3	Get filename, filename length and exit if necessary
4	Store filename and set input device
5	Set filename parameters and check for null tape filename
6	Set file, load parameters and execute modified LOAD
7	Check ST and, if valid, rechain lines and update program end parameters
8-9	End the loader program. Clear screen and variables for the RUN option

Variables Used

A$	Load or run keypress value
A	General purpose loop variable
N$	Filename
L	Filename length
ST	System variable that indicates the result (Status) of a LOAD attempt

Locations Accessed

45-46	End-of-program pointer
147	Load/verify flag
174-5	End-of-load address
183	Filename length
184	File number
185	Secondary address
186	Input/output device
187-8	Filename location
195-6	Relocated load address
1023	Start of screen RAM - 1
42291	ROM routine to rechain program lines
55295	Start of colour RAM - 1
62631	Special entry point into the operating system's LOAD routine

Software for Sale

If you think that one of our programs looks very interesting, but you can't afford the time to type it in then our software service will help you out

It's three o'clock in the morning. You sit at the computer keyboard having just finished a marathon typing session entering one of the superb programs from *Your Commodore*. Your fingers reach for the keyboard and press the letters R, U and N. You press RETURN, sit back and nothing happens.

Everyone has probably faced this problem. When it does happen it's a matter of spending hours searching through the program for any typing mistakes. No matter how long you look or how many people help you, you can usually guarantee that at least one little bug slips through unnoticed.

The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

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Please contact this address for prices and availability.

The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

This symbol means that the program is available on cassette.

These programs are available on disk.

Please Note

Since the programs supplied on cassette are total working versions of the program, we do not put disk-only programs on tape. There is no sense in placing a program that expects to be reading from disk on to tape.

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So if you have got something which you think we may be interested in. How do you go about submitting it to us?

Below you will find a list of guidelines that will help us to deal with any item that you send in to us. We don't expect everybody to be the next William Shakespeare but if you do follow these simple rules then it will make our job a lot easier.

1) If possible all material sent to the magazine should be typed or printed out on a computer printer.

2) All text should be double spaced i.e. there should be a blank line between each line of text. You should also leave a margin of about 10 characters around the text.

3) On the very first page you should put the following:
Name of the article
Machine that it is for
Any extras required - disk, printer etc.
Your name
Your address
Your telephone number

4) The top of every page should have the following information on it:
Abbreviation of the article title
Your name
The page number

For example, suppose you had submitted an article on C64 interrupts. You should put something like the following at the head of the page:

Interrupts/J.Smith/1

5) Please make sure that you do not make any additional marks on your text especially underlining.

6) Try and write in clear concise English, it does not have to be a work of literature but it must be comprehensible.

7) On the bottom of each page you should put the word MORE if there are more pages to the article or ENDS if it is the last page.

8) If possible, enclose a listing of all programs.

9) Under no circumstances use a staple to hold the pages together. Use a paperclip instead.

10) Programs should be included on either disk or tape. Make sure that you SAVE two copies of every program so that we have a better chance of loading them if problems occur.

11) Programs under 10 lines can be included in the text. If your program is longer than this you must enclose a disk or cassette.

12) If your article needs any artwork then supply clear examples of what is needed. We don't expect you to be an artist but we do need to see what is required.

13) Photographs, if necessary, must be either black and white prints or colour slides. We can take shots ourselves so don't worry about this too much.

14) Submissions of any length are welcome. If you have a five line routine that you think may be of use to someone else we welcome it just as much as a full blown six part series.

15) Payment varies quite a lot and depends on quite a number of factors, such as complexity of program, presentation of program, number of magazine pages it takes up etc. Payment is generally between £10.00 and £800.00.

16) All payments are made in the month that the magazine containing your article has appeared in print.

17) If we do find your submission suitable for inclusion in the magazine we will write to you giving the terms of publication, the rate of payment and an agreement form. Prompt return of this form will allow us to use your program as soon as possible.

18) If you want the program returning to you, should we find it unsuitable for publication, then you should enclose a stamped self addressed envelope.

19) The last and most important point to make is 'get writing', we are waiting for your articles.

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Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:

[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYNTAX CHECKER

```
5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10    :LN=70    :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time.

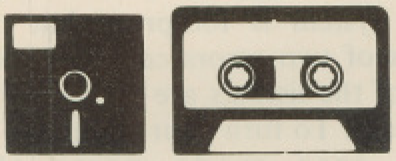
Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

YOUR

COMMODORE Listings

Tape Menu



PROGRAM: TAPE MENU

```
81   10 POKE53280,1:POKE53281,1
15   20 PRINT"[CLR,DOWN,RIGHT2]PR
     ESS [RVSON]STOP[RVSOFF] ON C
     ASSETTE"
65   30 WAIT1,55,39
E2   40 P=0:F=30:L=10:B=0:POKE0,6
     3
77   50 PRINT"[CLR,DOWN,RIGHT6]BA
     CK-UP TAPE 1 - SIDE A[DOWN]"
85   60 PRINTTAB(11)"[C7,SU,SC10,
     SI]"
07   70 PRINTTAB(9)"**[S-,C5]TAPE
      MENUX[C7,S-]**"
C2   80 PRINTTAB(11)"[SJ,SC10,SK]
     "
E9   90 PRINT"[DOWN,C5]PROG  NAME
     [SPC11]TAPE COUNTER"
EC   100 PRINT" NO[SPC3]MAX 16 CH
     RS[SPC6]FROM[SPC4]TO[GREEN]"
08   110 FORI=1TOL:READN,N$,S,E
EE   120 IFI=1THENK=E-1
FE   130 PRINTN"[UP]"
EC   140 PRINTTAB(4)N$"[UP]"
7D   150 PRINTTAB(20)S"[UP]"
6D   160 PRINTTAB(25)E"
28   170 NEXT
12   180 IFL<10THENL=10-L:FORI=1T
     OL:PRINT:NEXT
93   190 PRINT"[DOWN2,PURPLE,RIGH
     T]CHOOSE A NO AND PRESS 'RET
     URN' .."
CC   200 PRINT"[DOWN,RIGHT2,C5][
     PRESS 'SPACE' FOR NEXT PAGE
     ]"
3B   210 GOSUB690:IFB$=CHR$(13)TH
     EN210
AB   220 A$=B$:IFB$=" "THEN620
3B   230 PRINTTAB(32)"[PURPLE,UP3
     ]"A$;
BA   240 GOSUB690
71   250 IFB$=CHR$(13)THEN290
FA   260 PRINTB$
7B   270 GETC$:IFC$<>CHR$(13)THEN
     270
1B   280 B=(ASC(B$)-48)*10
A3   290 A=ASC(A$)-48:A=A+B
84   300 PRINT"[CLR,BLUE]":INPUT"
     [DOWN,RVSON]S[RVSOFF]AVE OR
     [RVSON]L[RVSOFF]OAD";Q$:Q$=L
     EFT$(Q$,1)
C4   310 IFQ$="S"THENA=A-1:GOTO33
     0
49   320 IFQ$<>"L"THENPRINT"[UP2]
     ":GOTO300
9A   330 RESTORE:IFA>XTHEN50
F9   340 FORP=1TOA:READN,N$,S,E:N
     EXT
BA   350 IFQ$="S"THEN410
7D   360 PRINT"[CLR,RED]FILENAME[
     SPC3,RVSON,BLUE]";N$"[RVSOFF
     ]":PRINT
98   370 IFA=1THEN580
D3   380 INPUT"[DOWN,RVSON]P[RVSO
     FF]ROGRAM OR [RVSON]F[RVSOFF
     ]ILE";T$:T$=LEFT$(T$,1):IFT$
     ="F"THEN400
64   390 INPUT"[DOWN,RVSON]A[RVSO
     FF]UTORUN";L$:L$=LEFT$(L$,1)
BC   400 C=S-K:GOTO420
B3   410 C=E+4-K
D8   420 POKE1,55:PRINT"[DOWN]PRE
     SS F/FWD AND RETURN WHEN REA
     DY"
9A   430 GOSUB730
E3   440 POKE1,7:T=TI
E3   450 IFC>180THENC=C+1
E7   460 IFC>340THENC=C+1
DA   470 IFC>390THENC=C+1
62   480 IFT+(C*14.75)>TITHEN480
83   490 POKE1,55
E1   500 PRINT"[DOWN]PRESS RETURN
      TO CONTINUE":GOSUB730
97   510 PRINT"[DOWN]COUNTER = ";
     S;:PRINT"[LEFT,SPC20]"
B5   520 PRINT"[DOWN]PRESS PLAY A
     ND RETURN WHEN READY"
13   530 GOSUB730
DC   540 IFL$<>"N"THEN590
2F   550 IFT$<>"P"THENPRINT"[DOWN
     ]YOUR FILE WILL LOAD NOW"
A5   560 PRINT"[DOWN]YOUR PROGRAM
      WILL LOAD NOW"
EE   570 GOSUB750:POKE0,47:POKE1,
     39:LOAD"",1,1:GOTO610
E2   580 PRINT"[C5,DOWN]THIS PROG
     /FILE IS ALREADY LOADED":GOT
     O610
A1   590 IFT$="P"THENPRINT"[DOWN]
     YOUR PROGRAM WILL LOAD AND R
     UN NOW"
C3   600 GOSUB750:POKE0,47:POKE1,
     39:POKE631,131:POKE198,1:GOT
     O610
E4   610 END
9B   620 L=N-(P*10)
05   630 P=P+1
39   640 F=F-(N/P):IFF<10THENL=F
F2   650 IFP>2THEN670
64   660 GOTO50
2C   670 RESTORE
67   680 GOTO40
E6   690 GETB$:IFB$=""THEN690
16   700 IFB$=CHR$(13)ORB$=" "THE
     NRETURN
75   710 IFASC(B$)<48ORASC(B$)>57
     THEN690
5C   720 RETURN
C3   730 GETA$:IFA$<>CHR$(13)THEN
     730
FC   740 PRINT"[CLR]":RETURN
9B   750 FORI=1TO2000:NEXT:RETURN
E1   1000 DATA1,TAPE MENU       ,
     000,009
63   1010 DATA2,PROGRAM NAME    ,
     000,000
62   1020 DATA3,PROGRAM NAME    ,
     000,000
10   1030 DATA4,PROGRAM NAME    ,
     000,000
0F   1040 DATA5,PROGRAM NAME    ,
     000,000
BE   1050 DATA6,PROGRAM NAME    ,
     000,000
35   1060 DATA7,PROGRAM NAME    ,
     000,000
24   1070 DATA8,PROGRAM NAME    ,
     000,000
D3   1080 DATA9,PROGRAM NAME    ,
     000,000
83   1090 DATA10,PROGRAM NAME
     ,000,000
74   1100 DATA11,PROGRAM NAME
     ,000,000
71   1110 DATA12,PROGRAM NAME
     ,000,000
BE   1120 DATA13,PROGRAM NAME
     ,000,000
A7   1130 DATA14,PROGRAM NAME
     ,000,000
D8   1140 DATA15,PROGRAM NAME
     ,000,000
BD   1150 DATA16,PROGRAM NAME
     ,000,000
AA   1160 DATA17,PROGRAM NAME
     ,000,000
BB   1170 DATA18,PROGRAM NAME
     ,000,000
EC   1180 DATA19,PROGRAM NAME
     ,000,000
FE   1190 DATA20,PROGRAM NAME
     ,000,000
11   1200 DATA21,PROGRAM NAME
     ,000,000
1C   1210 DATA22,PROGRAM NAME
     ,000,000
CB   1220 DATA23,PROGRAM NAME
     ,000,000
EA   1230 DATA24,PROGRAM NAME
     ,000,000
5D   1240 DATA25,PROGRAM NAME
```

```
     ,000,000
60   1250 DATA26,PROGRAM NAME
     ,000,000
AF   1260 DATA27,PROGRAM NAME
     ,000,000
A6   1270 DATA28,PROGRAM NAME
     ,000,000
C0   1280 DATA29,PROGRAM NAME
     ,000,000
22   1290 DATA30,PROGRAM NAME
     ,000,000
```

Sonic Effects

PROGRAM: SOUNDWRITE64

```
85   0 REM          ****************
     ***
6A   1 REM          *  SOUNDWRITE 64
     *
71   2 REM          *   BY  T.WALLS
     *
9E   3 REM          * V2.0        198
     8 *
81   4 REM          ****************
     ***
18   7 OPEN1,3
6F   8 NF=1
48   10 PRINT"[CLR]"
AF   20 POKE53280,0:POKE53281,0:P
     RINT"[WHITE]"
17   25 GOTO7000
2A   27 GOTO800
3C   30 PRINT"[HOME,DOWN6]"
17   40 PRINT"[RIGHT6,CA,S*13,CS]
     "
49   50 PRINT"[RIGHT6,S-]  MAIN M
     ENU  [S-]"
E4   60 PRINT"[RIGHT6,S-] [CT11]
     [S-]"
D3   70 PRINT"[RIGHT6,S-]1. HEAR
     SOUND[S-]"
82   80 PRINT"[RIGHT6,S-]2. DESIG
     N -  [S-]"
58   90 PRINT"[RIGHT6,S-,SPC4]SOU
     ND[SPC4,S-]"
26   100 PRINT"[RIGHT6,S-]3. OUTP
     UT -  [S-]"
E4   110 PRINT"[RIGHT6,S-,SPC4]SO
     UND[SPC4,S-]"
4A   115 PRINT"[RIGHT6,S-]4. CHOO
     SE -  [S-]"
D8   116 PRINT"[RIGHT6,S-,SPC4]FR
     AME[SPC4,S-]"
89   117 PRINT"[RIGHT6,S-]5. CREA
     TE[SPC4,S-]"
7D   118 PRINT"[RIGHT6,S-,SPC4]BA
     SIC[SPC4,S-]"
0D   119 PRINT"[RIGHT6,S-]6. PREF
     ERENCE[S-]"
11   120 PRINT"[RIGHT6,S-]7. QUIT
     [SPC6,S-]"
32   121 PRINT"[RIGHT6,CZ,S*13,CX
     ]"
D5   130 GETET$:IFET$=""THEN130
D5   140 V=VAL(ET$)
F9   150 ON V GOTO 200,400,600,80
     0,6500,9100,9050
C9   160 GOSUB9000:GOTO130
82   200 PRINT"[HOME,DOWN4]"
49   210 PRINT"[RIGHT10,CA,S*12,C
     S]"
DA   220 PRINT"[RIGHT10,S-] HEAR
     SOUND [S-]"
53   230 PRINT"[RIGHT10,S-,CT2]SU
     B-MENU[CT2,S-]"
3F   240 PRINT"[RIGHT10,S-] [CT10
     ] [S-]"
0D   250 PRINT"[RIGHT10,S-]1. REP
     EAT[SPC3,S-]"
FB   260 PRINT"[RIGHT10,S-]2. SET
     REP. [S-]"
33   270 PRINT"[RIGHT10,S-,SPC4]D
     ELAY[SPC3,S-]"
F0   280 PRINT"[RIGHT10,S-]3. SET
     NO.  [S-]"
BD   290 PRINT"[RIGHT10,S-,SPC4]O
     F REP.S[S-]"
9E   300 PRINT"[RIGHT10,S-]4. HEA
     R[SPC5,S-]"
DF   310 PRINT"[RIGHT10,S-,SPC4]S
     OUND[SPC3,S-]"
0A   311 PRINT"[RIGHT10,S-]5. MAI
     N -[SPC3,S-]"
23   312 PRINT"[RIGHT10,S-,SPC4]M
     ENU[SPC4,S-]"
FC   320 PRINT"[RIGHT10,CZ,S*12,C
     X]"
C8   330 GETET$:IFET$=""THEN330
72   340 V=VAL(ET$):ON V GOTO 100
     0,1300,1500,2000,30
AC   350 GOSUB9000:GOTO330
4E   400 PRINT"[HOME,DOWN3]"
E8   410 PRINT"[RIGHT8,CA,S*12,CS
     ]"
65   420 PRINT"[RIGHT8,S-]DESIGN
     SOUND[S-]"
AA   430 PRINT"[RIGHT8,S-,CT]SUB-
     MENU[CT3,S-]"
E6   440 PRINT"[RIGHT8,S-] [CT8,S
     PC3,S-]"
37   450 PRINT"[RIGHT8,S-]1. SET
     FREQ.[S-]"
1E   460 PRINT"[RIGHT8,S-]2. SET
     ADSR.[S-]"
04   470 PRINT"[RIGHT8,S-]3. SET
     VOL. [S-]"
6D   480 PRINT"[RIGHT8,S-]4. SET
     WAVE.[S-]"
B8   490 PRINT"[RIGHT8,S-]5. SET
     PULSE[S-]"
0A   500 PRINT"[RIGHT8,S-]6. MAIN
     MENU[S-]"
58   510 PRINT"[RIGHT8,CZ,S*12,CX
     ]"
70   520 GETET$:IFET$=""THEN520
7D   530 V=VAL(ET$)
C0   540 ON V GOTO3000,3500,3800,
     4200,4500,30
54   550 GOSUB9000:GOTO520
58   600 PRINT"[HOME,DOWN4]"
BE   610 PRINT"[RIGHT7,CA,S*14,CS
     ]"
DC   620 PRINT"[RIGHT7,S-] OUTPUT
     SOUND [S-]"
50   630 PRINT"[RIGHT7,S-] [CT2]S
     UB-MENU[CT2] [S-]"
AE   640 PRINT"[RIGHT7,S-]  [CT10
     ]  [S-]"
6D   650 PRINT"[RIGHT7,S-]1. SCRE
     EN[SPC5,S-]"
7E   660 PRINT"[RIGHT7,S-,SPC4]DE
     TAILS[SPC3,S-]"
D0   670 PRINT"[RIGHT7,S-]2. PRIN
     TER[SPC4,S-]"
5A   680 PRINT"[RIGHT7,S-,SPC4]DE
     TAILS[SPC3,S-]"
79   690 PRINT"[RIGHT7,S-]3. SAVE
     FRAME [S-]"
43   700 PRINT"[RIGHT7,S-]4. LOAD
     FRAME [S-]"
ED   710 PRINT"[RIGHT7,S-]5. MAIN
     MENU  [S-]"
E2   720 PRINT"[RIGHT7,CZ,S*14,CX
     ]"
11   730 GETET$:IFET$=""THEN730
23   740 V=VAL(ET$)
F0   750 ON V GOTO5000,5500,5600,
     5640,30
89   760 GOSUB9000:GOTO730
2C   800 GOSUB6000:PRINT"[HOME,DO
     WN4]"
CC   810 PRINT"[RIGHT10,CA,S*6,CS
     ]"
6B   820 PRINT"[RIGHT10,S-]CHOOSE
     [S-]"
AF   830 PRINT"[RIGHT10,S-]FRAME
     [S-]"
72   840 PRINT"[RIGHT10,S-]A-J[SP
     C3,S-]"
BC   850 PRINT"[RIGHT10,S-](1-10)
     [S-]"
C6   860 PRINT"[RIGHT10,CZ,S*6,CX
     ]"
DD   870 GETET$:IFET$=""THEN870
25   880 IF ET$="A"THEN NF=1:GOTO
     990
FF   890 IF ET$="B"THEN NF=2:GOTO
     990
19   900 IF ET$="C"THEN NF=3:GOTO
     990
C7   910 IF ET$="D"THEN NF=4:GOTO
     990
F5   920 IF ET$="E"THEN NF=5:GOTO
     990
AF   930 IF ET$="F"THEN NF=6:GOTO
     990
11   940 IF ET$="G"THEN NF=7:GOTO
     990
57   950 IF ET$="H"THEN NF=8:GOTO
     990
75   960 IF ET$="I"THEN NF=9:GOTO
     990
46   970 IF ET$="J"THEN NF=10:GOT
     O990
2B   980 GOSUB9000:GOTO870
ED   990 GOTO6300
3B   1000 PRINT"[HOME,CA,S*6,CS]"

9D   1010 PRINT"[S-]REPEAT[S-]"
96   1020 PRINT"[S-]0-OFF [S-]"
08   1030 PRINT"[S-]1-ON  [S-]"
9D   1040 PRINT"[CZ,S*6,CX]"
E7   1050 GETET$:IFET$=""THEN1050

0E   1060 IF ET$="0"THENGOTO1100
9A   1070 IF ET$="1"THENGOTO1200
63   1080 GOSUB9000:GOTO1050
2A   1100 RF=0
18   1110 PRINT"[HOME]"
7F   1120 PRINT"[CA,S*10,CS]"
72   1130 PRINT"[S-]REPEAT-OFF[S-
     ]"
49   1140 PRINT"[CZ,S*10,CX]"
3D   1150 GOTO200
CF   1200 RF=1
7C   1210 PRINT"[HOME]"
D3   1220 PRINT"[CA,S*10,CS]"
A4   1230 PRINT"[S-]REPEAT-ON [S-
     ]"
25   1240 PRINT"[CZ,S*10,CX]"
C1   1250 GOTO200
17   1300 PRINT"[HOME,DOWN4]"
EB   1305 NO$="000":RD=0
A4   1310 PRINT"[CA,S*9,CS]"
1C   1320 PRINT"[S-]DELAY,USE[S-]
     "
D3   1330 PRINT"[S-]CRSR← &  [S-]
     "
BB   1340 PRINT"[S-]CRSR↑ TO [S-]
     "
50   1350 PRINT"[S-]CHOOSE NO[S-]
     "
B9   1360 PRINT"[S-]NO-";NO$;"[SP
     C3,S-]"
46   1365 PRINT"[S-]* TO[SPC5,S-]
     "
BB   1366 PRINT"[S-,SPC3]FINISH[S
     -]"
DA   1370 PRINT"[CZ,S*9,CX]"
E8   1380 GETET$:IFET$=""THEN1380

6F   1382 GOSUB9000
41   1385 IF RD=99 THEN RD=98
C2   1386 IF ET$="*"THEN200
9A   1390 IF ET$="[UP]"ORET$="[DO
```

```
   WN]"AND RD>0 THEN RD=RD-1:GO
   TO1450
B0 1400 IF ET$="[RIGHT]"ORET$="
   [LEFT]"AND RD<98  THEN RD=RD
   +1:GOTO1450
4E 1410 GOSUB9000:GOTO1380
BD 1450 S$=STR$(RD)
CF 1460 IF LEN(S$)=1 THENNO$="0
   0"+S$:PRINT"[HOME,DOWN4]":GO
   TO1310
89 1461 IF LEN(S$)=2 THENNO$="0
   "+S$:PRINT"[HOME,DOWN4]":GOT
   O1310
A3 1462 IF LEN(S$)=3 THENNO$=S$
   :PRINT"[HOME,DOWN4]":GOTO131
   0
AF 1500 PRINT"[HOME,DOWN4]"
6F 1505 NO$="000":RP=0
6C 1510 PRINT"[CA,S*9,CS]"
0A 1520 PRINT"[S-]REPEATS  [S-]
   "
8B 1530 PRINT"[S-]CRSR← &  [S-]
   "
E4 1540 PRINT"[S-]CRSR↑ TO [S-]
   "
33 1550 PRINT"[S-]CHOOSE NO[S-]
   "
7E 1560 PRINT"[S-]NO-";NO$;"[SP
   C3,S-]"
0F 1565 PRINT"[S-]* TO[SPC5,S-]
   "
3C 1566 PRINT"[S-,SPC3]FINISH[S
   -]"
A5 1570 PRINT"[CZ,S*9,CX]"
1B 1580 GETET$:IFET$=""THEN1580

C2 1582 GOSUB9000
7C 1585 IF RP=99 THEN RP=98
E7 1586 IF ET$="*"THEN200
79 1590 IF ET$="[UP]"ORET$="[DO
   WN]"AND RP>0 THEN RP=RP-1:GO
   TO1650
89 1600 IF ET$="[RIGHT]"ORET$="
   [LEFT]"AND RP<98  THEN RP=RP
   +1:GOTO1650
97 1610 GOSUB9000:GOTO1580
94 1650 S$=STR$(RP)
C0 1660 IF LEN(S$)=1 THENNO$="0
   0"+S$:PRINT"[HOME,DOWN4]":GO
   TO1310
44 1661 IF LEN(S$)=2 THENNO$="0
   "+S$:PRINT"[HOME,DOWN4]":GOT
   O1510
C4 1662 IF LEN(S$)=3 THENNO$=S$
   :PRINT"[HOME,DOWN4]":GOTO151
   0
5A 2000 PRINT"[HOME,DOWN5]"
B1 2010 PRINT"[RIGHT7,CA,S*15,C
   S]"
54 2020 PRINT"[RIGHT7,S-] PLAYI
   NG SOUND [S-]"
BA 2025 PRINT"[RIGHT7,CZ,S*15,C
   X]"
CB 2026 FORN=PEEK(54296)TOOSTEP
   -1:POKE54296,N:NEXT
AB 2030 IF RF=1 THEN FORR=0 TO
   RP
9B 2031 FORL=54272TO54295:POKEL
   ,0:NEXT
CD 2032 FORN=PEEK(54296)TOOSTEP
   -1:POKE54296,N:NEXT
26 2033 POKE54277,AD(1):POKE542
   84,AD(2):POKE54291,AD(3)
F4 2034 POKE54278,SR(1):POKE542
   85,SR(2):POKE54292,SR(3)
13 2035 POKE54276,WF(1):POKE542
   83,WF(2):POKE54290,WF(3)
A7 2036 POKE54275,HP(1):POKE542
   82,HP(2):POKE54289,HP(3)
7B 2037 POKE54274,LP(1):POKE542
   81,LP(2):POKE54288,LP(3)
25 2038 POKE54273,HF(1):POKE542
   80,HF(2):POKE54287,HF(3)
CA 2039 POKE54272,LF(1):POKE542
   79,LF(2):POKE54286,LF(3)
C5 2040 POKE54296,VO
32 2045 IF RF=1THENFORC=0TORDST
   EP.1:NEXTC
0B 2050 IF RF=1THEN NEXTR
29 2070 GOTO200
D5 3000 PRINT"[HOME,DOWN4]"
6C 3010 PRINT"[RIGHT10,CA,S*6,C
   S]"
68 3020 PRINT"[RIGHT10,S-]ENTER
    [S-]"
75 3030 PRINT"[RIGHT10,S-]VOICE
   -[S-]"
78 3040 PRINT"[RIGHT10,S-](1-3)
    [S-]"
70 3050 PRINT"[RIGHT10,CZ,S*6,C
   X]"
15 3060 GETET$:IFET$=""THEN3060

52 3070 V=VAL(ET$)
DC 3080 IF V>3ORV<1THENGOSUB900
   0:GOTO3060
29 3090 PRINT"[HOME,DOWN5]"
6A 3100 PRINT"[RIGHT7,CA,S*10,C
   S]"
E2 3110 PRINT"[RIGHT7,S-]ENTER
   FORM[S-]"
B2 3120 PRINT"[RIGHT7,S-]1. HI-
   LO  [S-]"
BD 3130 PRINT"[RIGHT7,S-]2. FUL
   L(EG[S-]"
3D 3140 PRINT"[RIGHT7,S-,SPC4]1
   2980)[S-]"
6A 3150 PRINT"[RIGHT7,CZ,S*10,C
   X]"
1D 3160 GETET$:IFET$=""THEN3160

72 3170 Q=VAL(ET$)
24 3180 ON Q GOTO3200,3300
C5 3190 GOSUB9000:GOTO3160
03 3200 REM
F3 3271 PRINT"[CLR]ENTER HI FRE
   QUENCY-[SPC13]"
84 3272 INPUT HF(V)
3E 3273 IF HF(V)<0OR HF(V)>255
   THEN PRINT"NUMBERS 0-255 ONL
   Y":GOSUB9000:GOTO3272
36 3274 PRINT"[CLR]ENTER LO FRE
   QUENCY-[SPC13]"
2B 3275 INPUT LF(V)
81 3276 IF LF(V)<0OR LF(V)>255
   THEN PRINT"[HOME]NUMBERS 0-2
   55 ONLY":GOSUB9000:GOTO3275
E9 3280 GOTO400
7F 3300 REM
48 3380 PRINT"[CLR]ENTER FREQUE
   NCY-[SPC16]"
01 3390 INPUT FY
39 3400 F=FY/.06097
1E 3410 HF(V)=INT(F/256)
7E 3420 LF(V)=F-(256*HF(V))
8A 3421 IF HF(V)>255 OR HF(V)<0
   THENPRINT"[HOME]ILLEGAL FREQ
   UENCY!":GOSUB9000:GOTO3380
AF 3422 IF LF(V)>255 OR LF(V)<0
   THENPRINT"[HOME]ILLEGAL FREQ
   UENCY!":GOSUB9000:GOTO3380
80 3480 GOTO400
36 3500 REM
E5 3590 PRINT"[CLR]ENTER VOICE-
   [SPC20]"
ED 3600 INPUT V
29 3610 IF V>3ORV<1THENPRINT"[H
   OME]1-3 ONLY":GOSUB9000:GOTO
   3600
08 3620 PRINT"[CLR]ENTER ATTACK
   ,DECAY(1-15)-[SPC7]"
E2 3630 INPUTA,D:AD(V)=16*A+D
E9 3640 IF AD(V)>255 OR AD(V)<0
   THENPRINT"[HOME]1-15 ONLY":G
   OSUB9000:GOTO3630
C2 3650 PRINT"[CLR]ENTER SUSTAI
   N,RELEASE(1-15)-[SPC4]"
90 3660 INPUTS,R:SR(V)=16*S+R
1E 3670 IF SR(V)>255 OR SR(V)<0
   THENPRINT"[HOME]1-15 ONLY":G
   OSUB9000:GOTO3660
ED 3680 E=0
39 3710 GOTO400
21 3800 PRINT"[HOME,DOWN5]"
92 3810 PRINT"[RIGHT11,CA,S*12,
   CS]"
A1 3820 PRINT"[RIGHT11,S-]USE K
   EYS A-P[S-]"
BF 3830 PRINT"[RIGHT11,S-]TO SE
   LECT[SPC3,S-]"
8F 3840 PRINT"[RIGHT11,S-]VOLUM
   E(0-15)[S-]"
7D 3850 PRINT"[RIGHT11,CZ,S*12,
   CX]"
91 3860 GETET$:IFET$=""THEN3860

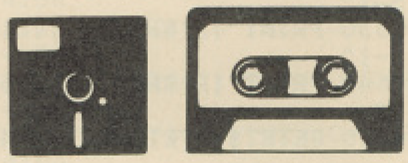
74 3870 IF ET$="A"THENVO=0:GOTO
   4100
40 3880 IF ET$="B"THENVO=1:GOTO
   4100
A0 3890 IF ET$="C"THENVO=2:GOTO
   4100
CC 3900 IF ET$="D"THENVO=3:GOTO
   4100
FC 3910 IF ET$="E"THENVO=4:GOTO
   4100
08 3920 IF ET$="F"THENVO=5:GOTO
   4100
28 3930 IF ET$="G"THENVO=6:GOTO
   4100
F4 3940 IF ET$="H"THENVO=7:GOTO
   4100
D4 3950 IF ET$="I"THENVO=8:GOTO
   4100
60 3960 IF ET$="J"THENVO=9:GOTO
   4100
25 3970 IF ET$="K"THENVO=10:GOT
   O4100
D9 3980 IF ET$="L"THENVO=11:GOT
   O4100
49 3990 IF ET$="M"THENVO=12:GOT
   O4100
AD 4000 IF ET$="N"THENVO=13:GOT
   O4100
0D 4010 IF ET$="O"THENVO=14:GOT
   O4100
29 4020 IF ET$="P"THENVO=15:GOT
   O4100
0B 4030 GOSUB9000:GOTO3860
11 4100 GOTO400
72 4200 PRINT"[HOME,DOWN4]"
A0 4210 PRINT"[RIGHT5,CA,S*18,C
   S]"
4F 4220 PRINT"[RIGHT5,S-]WAVEFO
   RMS POSSIBLE[S-]"
52 4230 PRINT"[RIGHT5,S-,CT18,S
   -]"
47 4240 PRINT"[RIGHT5,S-]1.[SM]
     [SN]TRIANGLE[SM]  [SN,S-]"

16 4250 PRINT"[RIGHT5,S-,SPC3,S
   M,SN]  [SM,SN]  [SM,SN]  [SM
   ,SN]  [S-]"
00 4260 PRINT"[RIGHT5,S-]2.[SN,
   CG,SN,CH]SAWTOOTH[SN,CH,SN,C
   H,S-]"
4E 4270 PRINT"[RIGHT5,S-]  [CN,
   SN,CN,SN,CN,SN,CN,SN,CN,SN,C
   N,SN,CN,SN,CN,SN,S-]"
60 4280 PRINT"[RIGHT5,S-]3.[CA,
   CS,CA,CS]PULSE[CS,CA,CS,CA,C
   S,CA,CS,S-]"
32 4290 PRINT"[RIGHT5,S-]  [CX,
   CZ,CX,CZ,CX,CZ,CX,CZ,CX,CZ,C
   X,CZ,CX,CZ,CX,CZ,S-]"
43 4300 PRINT"[RIGHT5,S-]4.[C+4
   ]WHITE[C+]NOISE[C+,S-]"
A6 4310 PRINT"[RIGHT5,S-]  [C+1
   0,S-]"
9C 4315 PRINT"[RIGHT5,S-,SPC4]E
   NTER NO.[SPC5,S-]"
E0 4320 PRINT"[RIGHT5,CZ,S*18,C
   X]"
35 4330 GETET$:IFET$=""THEN4330
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4D  4340 V=VAL(ET$)
0A  4350 IF V<1ORV>4THEN GOSUB90
    00:GOTO4330
24  4360 PRINT"[HOME,DOWN5]"
39  4370 PRINT"[RIGHT5,CA,S*5,CS
    ]"
B5  4380 PRINT"[RIGHT5,S-]ENTER[
    S-]"
BB  4390 PRINT"[RIGHT5,S-]VOICE[
    S-]"
41  4400 PRINT"[RIGHT5,S-](1-3)[
    S-]"
ED  4410 PRINT"[RIGHT5,CZ,S*5,CX
    ]"
88  4420 GETET$:IFET$=""THEN4420
3C  4430 IF VAL(ET$)<1ORVAL(ET$)
    >3THEN GOSUB9000:GOTO4420
6B  4440 Q=VAL(ET$)
FA  4450 IF V=1 THEN V=17
03  4460 IF V=2 THEN V=33
CB  4470 IF V=3 THEN V=65
57  4480 IF V=4 THEN V=129
02  4490 WF(Q)=V
9D  4495 GOTO400
A0  4500 PRINT"[HOME,DOWN5]"
A0  4510 PRINT"[RIGHT8,CA,S*5,CS
    ]"
3A  4520 PRINT"[RIGHT8,S-]ENTER[
    S-]"
D4  4530 PRINT"[RIGHT8,S-]VOICE[
    S-]"
E0  4540 PRINT"[RIGHT8,CZ,S*5,CX
    ]"
62  4550 GETET$:IFET$=""THEN4550
EA  4560 V=VAL(ET$)
BC  4570 IFV<1ORV>3 THEN GOSUB90
    00:GOTO4550
7A  4580 REM
F6  4650 PRINT"[HOME]"
1C  4660 PRINT"[HOME]ENTER HI PU
    LSE(0-15)[SPC12]"
4C  4670 INPUTHP(V)
C1  4680 IF HP(V)<0ORHP(V)>15 TH
    EN PRINT"[HOME]0-15 ONLY":GO
    SUB9000:GOTO4670
62  4690 PRINT"[HOME]ENTER LO PU
    LSE(0-255)[SPC11]"
02  4700 INPUTLP(V)
3F  4710 IF HP(V)<0ORHP(V)>255 T
    HEN PRINT"[HOME]0-255 ONLY":
    GOSUB9000:GOTO4700
9D  4750 GOTO400
9D  5000 PRINT"[HOME,DOWN4]"
B6  5010 PRINT"[RIGHT8,CA,S*6,CS
    ]"
5E  5020 PRINT"[RIGHT8,S-]PLEASE
    [S-]"
47  5030 PRINT"[RIGHT8,S-,CT]WAI
    T[CT,S-]"
84  5040 PRINT"[RIGHT8,CZ,S*6,CX
    ]"
47  5050 E=0:FORN=1024TO2023
F2  5060 E=E+1:POKE49152+E,PEEK(
    N):NEXT
C1  5061 GOSUB5070
E6  5062 GOTO600
2B  5070 PRINT"[CLR]"
5A  5080 PRINT"VOICE1","VOICE2",
    "VOICE3"
C6  5090 PRINT"[CA,S*4,CS]","[CA
    ,S*4,CS]","[CA,S*4,CS]"
2F  5100 PRINT"[S-]WAVE[S-]","[S
    -]WAVE[S-]","[S-]WAVE[S-]"
60  5110 PRINT"[CZ,S*4,CX]","[CZ
    ,S*4,CX]","[CZ,S*4,CX]"
E3  5120 PRINT WF(1),WF(2),WF(3)
19  5130 PRINT"[CA,S*3,CS]","[CA
    ,S*3,CS]","[CA,S*3,CS]"
93  5140 PRINT"[S-]A/D[S-]","[S-
    ]A/D[S-]","[S-]A/D[S-]"
BF  5150 PRINT"[CZ,S*3,CX]","[CZ
    ,S*3,CX]","[CZ,S*3,CX]"
7F  5160 PRINT AD(1),AD(2),AD(3)
41  5170 PRINT"[CA,S*3,CS]","[CA
    ,S*3,CS]","[CA,S*3,CS]"
87  5180 PRINT"[S-]S/R[S-]","[S-
    ]S/R[S-]","[S-]S/R[S-]"
D7  5190 PRINT"[CZ,S*3,CX]","[CZ
    ,S*3,CX]","[CZ,S*3,CX]"
03  5200 PRINT SR(1),SR(2),SR(3)
91  5210 PRINT"[CA,S*4,CS]","[CA
    ,S*4,CS]","[CA,S*4,CS]"
75  5220 PRINT"[S-]HIGH[S-]","[S
    -]HIGH[S-]","[S-]HIGH[S-]"
7F  5230 PRINT"[S-]FREQ[S-]","[S
    -]FREQ[S-]","[S-]FREQ[S-]"
E7  5240 PRINT"[CZ,S*4,CX]","[CZ
    ,S*4,CX]","[CZ,S*4,CX]"
4F  5250 PRINT HF(1),HF(2),HF(3)
    :IF PF$="PRINTER"THEN5260
5A  5251 PRINT"[SPC5]PRESS ANY K
    EY"
F1  5252 GETET$:IFET$=""THEN5252
D3  5253 PRINT"[CLR]"
D3  5260 PRINT"[CA,S*4,CS]","[CA
    ,S*4,CS]","[CA,S*4,CS]"
61  5270 PRINT"[S-]LOW [S-]","[S
    -]LOW [S-]","[S-]LOW [S-]"
79  5280 PRINT"[S-]FREQ[S-]","[S
    -]FREQ[S-]","[S-]FREQ[S-]"
E5  5290 PRINT"[CZ,S*4,CX]","[CZ
    ,S*4,CX]","[CZ,S*4,CX]"
94  5300 PRINT LF(1),LF(2),LF(3)
55  5310 PRINT"[CA,S*5,CS]","[CA
    ,S*5,CS]","[CA,S*5,CS]"
27  5320 PRINT"[S-]LOW  [S-]","[
    S-]LOW  [S-]","[S-]LOW  [S-]
    "
2E  5330 PRINT"[S-]PULSE[S-]","[
    S-]PULSE[S-]","[S-]PULSE[S-]
    "
7D  5340 PRINT"[CZ,S*5,CX]","[CZ
    ,S*5,CX]","[CZ,S*5,CX]"
04  5350 PRINT LP(1),LP(2),LP(3)
83  5360 PRINT"[CA,S*5,CS]","[CA
    ,S*5,CS]","[CA,S*5,CS]"
FB  5370 PRINT"[S-]HIGH [S-]","[
    S-]HIGH [S-]","[S-]HIGH [S-]
    "
93  5380 PRINT"[S-]PULSE[S-]","[
    S-]PULSE[S-]","[S-]PULSE[S-]
    "
AE  5390 PRINT"[CZ,S*5,CX]","[CZ
    ,S*5,CX]","[CZ,S*5,CX]"
3B  5400 PRINT HP(1),HP(2),HP(3)
1A  5405 IF PF$="PRINTER"THEN543
    0
03  5410 FORN=1TO4000:NEXT
F2  5420 E=0:FORN=1024TO2023:E=E
    +1:POKEN,PEEK(49152+E):NEXT
C5  5430 RETURN
9E  5500 PF$="PRINTER":OPEN2,4
38  5510 CMD2
B1  5520 GOSUB5080:PF$="SCREEN"
C8  5530 PRINT#2:CLOSE2:GOTO600
C4  5600 OPEN2,1,1,"SOUND-FILE"
F1  5610 PRINT#2,AD(1):PRINT#2,A
    D(2):PRINT#2,AD(3)
7B  5620 PRINT#2,SR(1):PRINT#2,S
    R(2):PRINT#2,SR(3)
FC  5625 PRINT#2,WF(1):PRINT#2,W
    F(2):PRINT#2,WF(3)
26  5630 PRINT#2,HP(1):PRINT#2,H
    P(2):PRINT#2,HP(3)
45  5631 PRINT#2,LP(1):PRINT#2,L
    P(2):PRINT#2,LP(3)
D5  5632 PRINT#2,HF(1):PRINT#2,H
    F(2):PRINT#2,HF(3)
00  5633 PRINT#2,LF(1):PRINT#2,L
    F(2):PRINT#2,LF(3)
90  5634 PRINT#2,VO:CLOSE2:GOTO6
    00
FE  5640 OPEN2,1,0,"SOUND-FILE"
9D  5641 INPUT#2,AD(1):INPUT#2,A
    D(2):INPUT#2,AD(3)
DA  5642 INPUT#2,SR(1):INPUT#2,S
    R(2):INPUT#2,SR(3)
D7  5643 INPUT#2,WF(1):INPUT#2,W
    F(2):INPUT#2,WF(3)
87  5644 INPUT#2,HP(1):INPUT#2,H
    P(2):INPUT#2,HP(3)
F6  5645 INPUT#2,LP(1):INPUT#2,L
    P(2):INPUT#2,LP(3)
03  5646 INPUT#2,HF(1):INPUT#2,H
    F(2):INPUT#2,HF(3)
CE  5647 INPUT#2,LF(1):INPUT#2,L
    F(2):INPUT#2,LF(3)
0E  5648 INPUT#2,VO:CLOSE2::GOTO
    600
DB  6000 PRINT"[HOME,DOWN6]"
B8  6010 PRINT"[RIGHT10,CA,S*6,C
    S]"
88  6020 PRINT"[RIGHT10,S-]PLEAS
    E[S-]"
79  6030 PRINT"[RIGHT10,S-] WAIT
     [S-]"
96  6040 PRINT"[RIGHT10,CZ,S*6,C
    X]"
0A  6050 SP=22*NF:SP=SP+1:SP=SP+
    49152:SP=SP+1100
A7  6060 POKESP,AD(1):POKESP+1,A
    D(2)
36  6070 POKESP+2,AD(3)
9B  6080 POKESP+3,SR(1):POKESP+4
    ,SR(2)
B7  6090 POKESP+5,SR(3)
B5  6100 POKESP+6,WF(1):POKESP+7
    ,WF(2)
2C  6110 POKESP+8,WF(3)
1E  6120 POKESP+9,HP(1):POKESP+1
    0,HP(2)
1D  6130 POKESP+11,HP(3)
01  6140 POKESP+12,LP(1):POKESP+
    13,LP(2)
91  6150 POKESP+14,LP(3)
5C  6160 POKESP+15,HF(1):POKESP+
    16,HF(2)
FC  6170 POKESP+17,HF(3)
9E  6180 POKESP+18,LF(1):POKESP+
    19,LF(2)
3A  6190 POKESP+20,LF(3)
7E  6200 POKESP+21,VO
D4  6210 RETURN
FE  6300 PRINT"[HOME,DOWN8]"
4D  6310 PRINT"[RIGHT10,CA,S*6,C
    S]"
C3  6320 PRINT"[RIGHT10,S-]PLEAS
    E[S-]"
90  6330 PRINT"[RIGHT10,S-] WAIT
     [S-]"
7D  6340 PRINT"[RIGHT10,S-]AGAIN
    [CA,CX]"
2B  6350 PRINT"[RIGHT10,CZ,S*5,C
    X]"
A3  6360 SP=22*NF:SP=SP+1:SP=SP+
    49152:SP=SP+1100
B2  6370 FORN=1TO3:AD(N)=PEEK(SP
    ):SP=SP+1:NEXT
D0  6380 FORN=1TO3:SR(N)=PEEK(SP
    ):SP=SP+1:NEXT
26  6390 FORN=1TO3:WF(N)=PEEK(SP
    ):SP=SP+1:NEXT
D2  6400 FORN=1TO3:HP(N)=PEEK(SP
    ):SP=SP+1:NEXT
D8  6410 FORN=1TO3:LP(N)=PEEK(SP
    ):SP=SP+1:NEXT
10  6420 FORN=1TO3:HF(N)=PEEK(SP
    ):SP=SP+1:NEXT
BA  6430 FORN=1TO3:LF(N)=PEEK(SP
    ):SP=SP+1:NEXT
1A  6440 VO=PEEK(SP):GOTO30
AE  6500 PRINT"[HOME,DOWN7]"
8D  6501 PRINT"[RIGHT10,CA,S*10,
    CS]"
7F  6502 PRINT"[RIGHT10,S-]PRESS
     ← TO[S-]"
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EE  6503 PRINT"[RIGHT10,CZ,S*2,C
    S]QUIT[CA,S*2,CX]"
3F  6504 PRINT"[RIGHT13,CZ,S*4,C
    X]"
9B  6505 GETET$:IF ET$=""THEN650
    5
FD  6506 IF ET$="←"THENGOSUB9000
    :GOTO30
6D  6507 GOSUB6000:POKE828,NF:PR
    INT"[HOME,DOWN7]"
4D  6510 PRINT"[RIGHT9,CA,S*4,CS
    ]"
90  6520 PRINT"[RIGHT9,S-]HOLD[S
    -]"
F8  6530 PRINT"[RIGHT9,S-]IT[CA,
    S*,CX]"
E7  6540 PRINT"[RIGHT9,CZ,S*2,CX
    ]"
23  6550 FORN=0TO999:POKE49152+N
    ,PEEK(1024+N):NEXT
F3  6560 PRINT"[CLR]"
F8  6570 INPUT"ENTER FIRST LINE
    NO.";FL$
8F  6580 IF VAL(FL$)>10000 THEN6
    600
EC  6590 PRINT"?ERROR-PROGRAM LI
    ABLE TO OVERWRITE CODE":FORN
    =1TO2000:NEXT
2C  6595 GOSUB9000:GOTO6560
2B  6600 PRINT"[CLR]"
1D  6610 INPUT"ENTER SIZE OF LIN
    E INCREMENT";SP$
1E  6620 IF VAL(SP$)>0 THEN6650
3D  6630 PRINT"?ERROR-INVALID ST
    EP-SIZE ENTRY (";SP$;")":GOS
    UB9000
A0  6640 FORN=1TO2000:NEXT:GOTO6
    600
D4  6650 GOTO6750:PRINT"[CLR]"
F4  6655 PRINT"[DOWN3]"
23  6660 PRINTFL$;" REM PLAY SOU
    ND"
5A  6665 PRINT"GOTO6690"
55  6670 POKE198,0:POKE198,3:POK
    E631,13:POKE632,13:POKE633,1
    3
CA  6680 PRINT"[HOME]":STOP
B8  6690 FL=VAL(FL$):FL=FL+VAL(S
    P$):FL$=STR$(FL)
3A  6700 PRINT"[CLR]":PRINT"[DOW
    N3]"
8E  6710 PRINTFL$;" POKE54296,";
    VO;":REM SET VOLUME"
DF  6720 PRINT"GOTO6740"
D3  6730 POKE198,0:POKE198,3:POK
    E631,13:POKE632,13:POKE633,1
    3:PRINT"[HOME]":STOP
F4  6750 FL=VAL(FL$):FL=FL+VAL(S
    P$):FL$=STR$(FL)
96  6760 PRINT"[CLR]":PRINT"[DOW
    N3]"
99  6765 PRINTFL-VAL(SP$);"FORN=
    5427TO54295:POKEN,0:NEXT"
8B  6770 PRINTFL;"POKE54277,";AD
    (1);":POKE54284,";AD(2);":PO
    KE54291,";AD(3)
F1  6780 FL=FL+VAL(SP$)
49  6790 PRINTFL;"POKE54279,";SR
    (1);":POKE54285,";SR(2);":PO
    KE54292,";SR(3)
95  6800 FL=FL+VAL(SP$)
2A  6810 PRINTFL;"POKE54276,";WF
    (1);":POKE54283,";WF(2);":PO
    KE54290,";WF(3)
A9  6820 FL=FL+VAL(SP$)
C9  6830 PRINTFL;"POKE54275,";HP
    (1);":POKE54282,";HP(2);":PO
    KE54289,";HP(3)
4D  6840 FL=FL+VAL(SP$)
C0  6850 PRINTFL;"POKE54274,";LP
    (1);":POKE54281,";LP(2);":PO
    KE54288,";LP(3)
81  6860 FL=FL+VAL(SP$)
F5  6870 PRINTFL;"POKE54273,";HF
    (1);":POKE54280,";HF(2);":PO
    KE54287,";HF(3)
A5  6880 FL=FL+VAL(SP$)
6B  6890 PRINTFL;"POKE54272,";LF
    (1);":POKE54279,";LF(2);":PO
    KE54286,";LF(3)
B9  6900 FL=FL+VAL(SP$)
2D  6901 PRINTFL;"POKE54296,";VO
    ;":RETURN:REM FINISHED"
05  6902 PRINT"GOTO6960"
DF  6910 POKE198,11:FORN=631TO63
    1+11:POKEN,13:NEXT:PRINT"[HO
    ME]":STOP
5E  6920 FL$=STR$(FL):PRINT"[CLR
    ]":PRINT"[DOWN3]"
1B  6930 PRINTFL$;" POKE54296,";
    VO;":RETURN:REM FINISHED"
54  6940 PRINT"GOTO6960"
1D  6950 POKE198,3:POKE631,13:PO
    KE632,13:POKE633,13:PRINT"[H
    OME]":STOP
72  6960 PRINT"[CLR]":FORN=0TO99
    9:POKE1024+N,PEEK(49152+N):N
    EXT:NF=PEEK(828):GOTO6300
14  7000 PRINT"[HOME,DOWN7]"
19  7010 PRINT"[RIGHT11,CA,S*7,C
    S]"
13  7020 PRINT"[RIGHT11,S-]DO YO
    U [S-]"
AD  7030 PRINT"[RIGHT11,S-]WISH
    TO[S-]"
24  7040 PRINT"[RIGHT11,S-]CLEAR
     [S-]"
52  7050 PRINT"[RIGHT11,S-]MEMOR
    Y[CA,CX]"
7E  7060 PRINT"[RIGHT11,S-](Y/N)
    [CA,CX]"
21  7070 PRINT"[RIGHT11,CZ,S*5,C
    X]"
8F  7080 GETET$:IFET$=""THEN7080
03  7090 IF ET$="N"THEN27
E7  7100 IF ET$<>"Y"THENGOSUB900
    0:GOTO7080
E7  7105 PRINT"[HOME,DOWN5]"
BE  7106 PRINT"[RIGHT8,CA,S*6,CS
    ]"
95  7107 PRINT"[RIGHT8,S-]PLEASE
    [S-]"
01  7108 PRINT"[RIGHT8,S-] WAIT
    [S-]"
51  7109 PRINT"[RIGHT8,CZ,S*6,CX
    ]"
01  7110 FORN=49152TO49152+1230:
    POKEN,0:NEXT
A5  7120 GOTO30
E2  9000 FORL=54272TO54295:POKEL
    ,0:NEXT
DD  9005 POKE54277,10:POKE54284,
    0:POKE54291,0
39  9010 POKE54279,0:POKE54285,0
    :POKE54292,0
F7  9015 POKE54276,33:POKE54283,
    0:POKE54290,0
12  9020 POKE54275,0:POKE54282,0
    :POKE54289,0
D8  9025 POKE54274,0:POKE54281,0
    :POKE54288,0
EC  9030 POKE54273,150:POKE54280
    ,0:POKE54287,0
CF  9035 POKE54272,209.152054:PO
    KE54279,0:POKE54286,0
59  9040 POKE54296,15:RETURN:REM
     FINISHED
E2  9050 REM QUIT:GOSUB9000
17  9060 STOP
40  9100 REM PREFERENCES
B7  9110 PRINT"[HOME,DOWN4]"
67  9120 PRINT"[RIGHT7,CA,S*13,C
    S]"
97  9130 PRINT"[RIGHT7,S-] PREFE
    RENCES [S-]"
DB  9140 PRINT"[RIGHT7,CQ,S*13,C
    W]"
46  9150 PRINT"[RIGHT7,S-]1. PAP
    ER[SPC5,S-]"
19  9160 PRINT"[RIGHT7,S-]2. BOR
    DER[SPC4,S-]"
28  9170 PRINT"[RIGHT7,S-]3. INK
    [SPC7,S-]"
9B  9180 PRINT"[RIGHT7,S-]4. RET
    URN[SPC4,S-]"
15  9190 PRINT"[RIGHT7,CZ,S*13,C
    X]"
9B  9200 GETET$:IFET$=""THEN9200
E6  9210 ON VAL(ET$)GOTO9300,940
    0,9500,30
F8  9220 GOSUB 9000:GOTO9200
00  9300 INPUT"[HOME] [RVSON]PAP
    ER[RVSOFF] COLOUR[SPC8]";ET
38  9310 IF ET>15ORET<0THEN9300
9D  9320 POKE53281,ET:GOTO9110
4C  9400 INPUT"[HOME] [RVSON]BOR
    DER[RVSOFF] COLOUR[SPC7]";ET
9C  9410 IF ET>15ORET<0THEN9300
7C  9420 POKE53280,ET:GOTO9110
6F  9500 INPUT"[HOME] [RVSON]INK
    [RVSOFF] COLOUR[SPC10]";ET
D1  9510 IF ET>15ORET<0THEN9300
71  9520 POKE646,ET:GOTO9110
```

F Dump

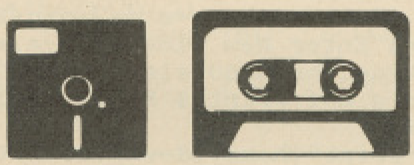


PROGRAM: TEXT SCREEN PRINT

```
AF  10 REM**********************
    ***********
CF  20 REM**
              **
F0  30 REM**     TEXT SCREEN PRIN
    TER       **
E0  35 REM**
              **
68  40 REM**        BY N.J.BURTON
              **
D6  45 REM**
              **
E7  50 REM**********************
    ***********
6A  60 T = 0
EE  70 FOR X = 49152 TO 49409
B6  80 READ A
7F  90 T=T+A
A8  100 POKEX,A
EC  110 NEXT
B6  120 IF T <> 31803 THEN PRINT
     "ERROR IN DATA!"
02  130 END
35  200 DATA  0, 0, 0, 0, 120, 1
    69, 17, 141, 20, 3
42  210 DATA  169, 192, 141, 21,
     3, 88, 96, 165, 197, 201
53  220 DATA  4, 208, 13, 169, 0
    , 141, 14, 220, 32, 39
7D  230 DATA  192, 169, 1, 141,
    14, 220, 76, 49, 234, 120
EF  240 DATA  169, 4, 162, 4, 16
    0, 0, 32, 186, 255, 169
09  250 DATA  0, 32, 189, 255, 3
    2, 192, 255, 162, 4, 32
98  260 DATA  201, 255, 169, 0,
    133, 251, 169, 4, 133, 252
E8  270 DATA  169, 102, 133, 253
    , 169, 3, 133, 254, 162, 0
ED  280 DATA  169, 0, 141, 3, 19
    2, 160, 0, 177, 251, 141
94  290 DATA  0, 192, 169, 0, 14
    1, 1, 192, 56, 169, 127
A3  300 DATA  205, 0, 192, 176,
    18, 169, 18, 32, 207, 192
```

```
79  310 DATA  173, 0, 192, 41, 1
    27, 141, 0, 192, 169, 1
A3  320 DATA  141, 1, 192, 56, 1
    73, 0, 192, 201, 32, 176
DC  330 DATA  8, 9, 64, 141, 0,
    192, 76, 155, 192, 56
DD  340 DATA  169, 63, 205, 0, 1
    92, 176, 8, 173, 0, 192
CD  350 DATA  9, 128, 141, 0, 19
    2, 173, 0, 192, 32, 207
2A  360 DATA  192, 173, 1, 192,
    201, 1, 208, 5, 169, 146
80  370 DATA  32, 207, 192, 200,
     192, 40, 208, 165, 169, 13
77  380 DATA  32, 207, 192, 32,
    226, 192, 32, 244, 192, 232
06  390 DATA  224, 25, 208, 142,
     32, 204, 255, 169, 4, 32
E7  400 DATA  195, 255, 32, 231,
     255, 88, 96, 141, 2, 192
85  410 DATA  152, 72, 172, 3, 1
    92, 173, 2, 192, 145, 253
85  420 DATA  238, 3, 192, 104,
    168, 96, 169, 15, 32, 210
59  430 DATA  255, 160, 0, 177,
    253, 32, 210, 255, 200, 201
90  440 DATA  13, 208, 246, 96,
    165, 251, 24, 105, 40, 133
3C  450 DATA  251, 165, 252, 105
    , 0, 133, 252, 96
```

Data Loader



PROGRAM: DATA LOADER C64

```
42  10 POKE55,255:POKE56,47:CLR:
    B=53280:POKEB,15:POKEB+1,1:R
    $=CHR$(13)
B7  20 PRINT"[CLR,DOWN,REV N,REV
     K,PURPLE,SPC4,SD] [SA] [ST]
     [SA,SPC3,SL] [SO] [SA] [SD]
     [SE] [SR,SPC3]6 4"R$TAB(14)
    "[DOWN,RED,SD]ESIGNED [SB]Y
26  30 PRINTTAB(14)"[DOWN,BLUE,S
    D]. [SR]. [SM]URR."R$"[DOWN,
    C8,S*40]
97  40 X=40961:Y=49151:Z=53249:D
    $=CHR$(20):O$=CHR$(0):FORB=0
    TO38:E$=E$+" ":NEXT
A0  50 N$="[HOME,DOWN]"+E$+R$+E$
    +"[HOME,DOWN,C7] ":P$="[GREE
    N,SP]LEASE [SW]AIT...[UP]":S
    $="[C7] [SP]RESS '[SS]PACE'.
    .."
28  60 M$="[HOME,DOWN,C7] [RVSON
    ,SE,RVSOFF]NTER  [RVSON,SM,R
    VSOFF]ODIFY  [RVSON,SN,RVSOF
    F]EXT  [RVSON,SP,RVSOFF]REVI
    OUS  [RVSON,SG,RVSOFF]OTO"+R
    $
D4  70 M$=M$+" [RVSON,SI,RVSOFF]
    NSERT  [RVSON,SD,RVSOFF]ELET
    E  [RVSON,SR,RVSOFF]ECOVER
    [RVSON,SS,RVSOFF]AVE  [RVSON
    ,SQ,RVSOFF]UIT"
05  80 DIMA,C,D,E,F,G,H,K,L,M,N,
    O,Q,R,S,V,V%,A$,B$,C$,A$(1),
    H$(1),N$(1),M$(2)
98  90 B=54272:FORA=0TO13:READC:
    POKEB+A,C:NEXT:POKEB+24,15
4A  100 DATA17,64,0,0,16,0,240,1
    04,6,0,0,32,0,240
0F  110 FORA=0TO1:READA$(A),H$(A
    ),N$(A):NEXT:FORA=0TO2:READM
    $(A):NEXT
F7  120 DATA12288-40944/49152-53
    232,"[SD]ECIMAL",,$3000-$9FF
    0/$C000-$CFF0,"[SH]EX ($)",S
84  130 DATA"[SG]OTO","[SD]ELETE
    ","[SI]NSERT"
E1  140 H=0:PRINT"[HOME,DOWN8]":
    FORF=0TO4:PRINTR$E$:NEXT
96  150 PRINT"[HOME,DOWN8,BLACK,
    SL]OAD [SF]ILE (Y/N)?  [LEFT
    ]";
D5  160 GETC$:IFC$<>"Y"ANDC$<>"N
    "THEN160
4B  170 PRINTC$R$R$:IFC$="Y"THEN
    GOSUB2000:GOTO430
19  180 PRINT"[UP,SB]LOCK [SS]IZ
    E (8-16)? ";:L=2:GOSUB1000:I
    FD<8ORD>16THENGOSUB6000:GOTO
    180
60  190 G=D:PRINT"[DOWN,RVSON,SH
    ,RVSOFF]EX OR [RVSON,SD,RVSO
    FF]ECIMAL? ";
EF  200 GETC$:IFC$<>"D"ANDC$<>"H
    "THEN200
5E  210 PRINTC$:H=-(C$="H"):PRIN
    T"[DOWN]([SR]ANGES: "A$(H)")
    "R$R$
BB  220 PRINT"[UP,SS]TART [SA]DD
    RESS?[SPC6,LEFT5]";:L=5-H:GO
    SUB1000
D8  230 IFD<12288OR(D>40944ANDD<
    49152)ORD>53232THENGOSUB6000
    :GOTO220
EC  240 A=D:C=D:E=D:PRINT"[DOWN,
    SA]LL [SC]ORRECT (Y/N)?
24  250 GETC$:IFC$="N"THEN140
90  260 IFC$<>"Y"THEN250
7A  270 P$=" "+P$:PRINT"[CLR,C8,
    RVSON,CP40]
7F  280 PRINTM$R$"[DOWN,C8,S*,RV
    SON,SA,SD2,SR,SE,SS2,RVSOFF,
    S*2,RVSON,SD,SA,ST,SA,RVSOFF
    ,S*26]
31  290 GOSUB3000
A6  300 GETC$:IFC$="E"THEN290
A8  310 IFC$="R"THENGOSUB5000:GO
    TO290
45  320 IFC$="Q"THEN390
7E  330 IFN=0THEN300
96  340 IFC$="M"OR(C$="N"ANDC<E)
    THEN290
D2  350 IFC$="P"ANDC-G>ATHENC=C-
    2*G:GOTO290
AA  360 IFC$="S"THENGOSUB4000:GO
    TO300
12  370 IFC$="G"ORC$="I"ORC$="D"
    THENGOSUB5000:GOTO290
47  380 GOTO300
7B  390 PRINTN$"[SQ]UIT [SP]ROGR
    AM (Y/N)?
0C  400 GETC$:IFC$="N"THENPRINTM
    $:GOTO300
3F  410 IFC$="Y"THEN460
80  420 GOTO400
4C  430 PRINT"[DOWN,RVSON,SC,RVS
    OFF]ONTINUE [RVSON,SE,RVSOFF
    ]ND?
26  440 GETC$:IFC$="C"THEN270
CD  450 IFC$<>"E"THEN440
15  460 SYS65126
46  1000 PRINT"[RVSON] [RVSOFF]
     [LEFT3]";
2A  1010 GETC$:IFC$="[F1]"ANDQ=1
    THEN1100
B4  1020 IFC$=D$ANDK>0THENK=K-1:
    B$=LEFT$(B$,K):PRINT"[LEFT]"
    ;:GOTO1000
79  1030 IFC$=R$ANDK>0THEN1080
05  1040 IFK=LTHEN1010
47  1050 D=ASC(C$+CHR$(0))-48
5B  1060 IF(H=0AND(D<0ORD>9))OR(
    H=1AND(D<0OR(D>9ANDD<17)ORD>
    22))THEN1010
9D  1070 B$=B$+C$:PRINTC$;:K=K+1
    :GOTO1000
0C  1080 PRINT" ":D=0:IFH=0THEND
    =VAL(B$):GOTO1100
7E  1090 L=LEN(B$):FORK=1TOL:V=A
    SC(MID$(B$,K,1))-48:V=V+7*(V
    >9):D=D+V*16↑(L-K):NEXT
FA  1100 K=0:Q=0:B$="":RETURN
73  2000 A$="":INPUT"[UP,SF]ILE
    [SN]AME";A$:IFLEN(A$)=0ORLEN
    (A$)>16THENGOSUB6000:GOTO200
    0
F0  2010 OPEN15,8,15,"I":OPEN1,8
    ,8,"0:"+A$+",P,R":INPUT#15,F
    ,C$:CLOSE1:CLOSE15
9B  2020 IFF<20THEN2070
6D  2030 GOSUB6000:PRINT"[DOWN,G
    REEN]"C$"!"R$"[DOWN,BLACK,ST
    ]RY [SA]GAIN (Y/N)?[UP]
30  2040 GETC$:IFC$="N"THEN460
05  2050 IFC$="Y"THENPRINTE$R$"[
    UP3]"E$"[UP2]":GOTO2000
03  2060 GOTO2040
64  2070 PRINTR$P$:OPEN1,8,8,A$+
    ",P,R":GET#1,B$,C$:A=ASC(B$+
    O$)+256*(ASC(C$+O$))
C8  2080 GET#1,B$,C$:E=ASC(B$+O$
    )+256*(ASC(C$+O$)):FORF=ATOE
    -1:GET#1,B$
CE  2090 POKEF,ASC(B$+O$):NEXT:G
    ET#1,B$:CLOSE1:F=ASC(B$+O$):
    G=FAND31:H=(FAND32)/32
86  2100 C=E-G:N=(E-A)/G:L=4
C4  2110 PRINT"[BLACK,SB]LOCK [S
    S]IZE ="G;R$"[DOWN,SM]ODE =
    "H$(H)R$"[DOWN,SS]TART [SA]D
    DRESS =";:D=A:GOSUB7000
87  2120 PRINTR$"[DOWN,SN]EXT [S
    A]DDRESS =";:D=E:GOSUB7000:P
    RINTR$"[DOWN,SB]LOCKS [SD]ON
    E ="N:RETURN
D4  3000 IFC$<>"E"OR(A<YANDE+G<X
    )OR(A>YANDE+G<Z)THEN3040
23  3010 GOSUB6000:PRINTN$"[GREE
    N,SO]UT [SO]F [SM]EMORY!"R$S
    $
FE  3020 GETC$:IFC$=" "THEN3160
ED  3030 GOTO3020
69  3040 IFC$="E"THENC=E:M=2:N=N
    +1:PRINTN$"[SE]NTER [SN]EW [
    SB]LOCK...
39  3050 IFM=3ORN=0THEN3160
1D  3060 IFC$="M"THENC=C-G:M=1:P
    RINTN$"[SM]ODIFY [ST]HIS [SB
    ]LOCK...
FE  3070 PRINT"[HOME,DOWN3,C3] [
    SB]LOCK"(C-A)/G+1"[LEFT]  [L
    EFT]OF"N"[LEFT] [SB]LOCK"N$(
    -(N>1))"  [BLACK]"R$"[DOWN]"
    ;
AD  3080 IFM=2THENFORF=0TOG:PRIN
    TE$:NEXT:PRINT"[HOME,DOWN5]"
    ;
72  3090 S=0:FORF=1TOG:D=C:L=4:G
    OSUB7000:B$="":PRINT,
9D  3100 IFM<2THEND=PEEK(C):L=2:
    GOSUB7000:IFM=1THENK=2*H+(1-
    H)*(1-(D>9)-(D>99))
4B  3110 IFM=0THEN3140
2D  3120 L=3-H:GOSUB1000:PRINT"[
    UP]",:IFD>255THENGOSUB6000:G
    OTO3100
F2  3130 POKEC,D:L=2:GOSUB7000
BC  3140 PRINT:C=C+1:S=S+D:NEXT:
    PRINT" [SC]HECKSUM =";:L=4:D
    =S:GOSUB7000:PRINT"[WHITE]"F
    RE(0)
66  3150 IFM>0THENPOKEB+4,17:FOR
    V=0TO299:NEXT:POKEB+4,16
18  3160 PRINTM$:E=E-G*(C>E):K=0
    :M=0:B$="":RETURN
CC  4000 PRINTN$"[SS]AVE [SB]LOC
    K"N$(-(N>1))" (Y/N)?[UP]
F8  4010 GETC$:IFC$="N"THEN4190
EE  4020 IFC$<>"Y"THEN4010
8D  4030 PRINTN$"[SF]ILE [SN]AME
     "A$R$"[UP]",
CF  4040 INPUTB$:IFLEN(B$)=0ORLE
```

```
    N(B$)>16THENGOSUB6000:GOTO40
    30
46  4050 A$=B$:OPEN15,8,15,"I":O
    PEN1,8,8,"0:"+A$+",P,W":INPU
    T#15,F,C$:CLOSE1:CLOSE15
33  4060 C$=" [GREEN]"+C$+"! [C7
    ]":IFF<>63THEN4110
08  4070 GOSUB6000:PRINTC$"[SO]V
    ERWRITE (Y/N)?[UP]
F2  4080 GETC$:IFC$="N"THEN4190
30  4090 IFC$="Y"THENPRINTE$"[UP
    ]":GOTO4160
29  4100 GOTO4080
D0  4110 IFF<20THEN4160
3A  4120 GOSUB6000:PRINTC$"[ST]R
    Y [SA]GAIN (Y/N)?
77  4130 GETC$:IFC$="N"THEN4190
57  4140 IFC$="Y"THEN4030
55  4150 GOTO4130
A6  4160 PRINTP$:OPEN1,8,8,"@0:"
    +A$+",P,W":V%=A/256:PRINT#1,
    CHR$(A-256*V%)CHR$(V%);
B7  4170 V%=E/256:PRINT#1,CHR$(E
    -256*V%)CHR$(V%);
E1  4180 FORF=ATOE-1:PRINT#1,CHR
    $(PEEK(F));:NEXT:F=G+32*H:PR
    INT#1,CHR$(F);:CLOSE1
02  4190 PRINTM$:B$="":RETURN
70  5000 IF(C$="I"OR(C$="R"ANDR>
    0))AND((A<YANDE+G>X-1)OR(A>Y
    ANDE+G>Z-1))THENC$="E":RETUR
    N
4E  5010 S=H:H=0:L=3:M=-(C$="D")
    -2*(C$="I")-3*(C$="R"):PRINT
    N$;:IFM<3THEN5100
DB  5020 IFR>0THEN5060
F8  5030 GOSUB6000:PRINT"[GREEN,
    SN]O [SB]LOCK TO [SR]ECOVER!
    "R$S$
9F  5040 GETC$:IFC$=" "THEN5190
4D  5050 GOTO5040
D4  5060 PRINT"[SR]ECOVER [SB]LO
    CK"R"[LEFT] (Y/N)?
1D  5070 GETC$:IFC$="Y"THEND=R:R
    =0:GOTO5130
F1  5080 IFC$="N"THEN5190
88  5090 GOTO5070
B1  5100 PRINT"[HOME,DOWN] "M$(M
    )" [SB]LOCK ([RVSON,SF]1[RVS
    OFF]=[SA]BORT)? ";
09  5110 Q=1:GOSUB1000:IFC$=CHR$
    (133)THENM=3:GOTO5190
03  5120 IFD<1ORD>NTHENGOSUB6000
    :GOTO5100
49  5130 C=A+(D-1)*G:IFM>1THENPR
    INTP$:FORF=ETOCSTEP-1:POKEF+
    G,PEEK(F):NEXT:E=E+G:N=N+1
81  5140 IFM=3THENM=0:FORF=0TOG-
    1:POKEC+F,PEEK(1008+F):NEXT
A2  5150 IFM=2THENPRINTN$M$(M)"
    [SB]LOCK"(C-A)/G+1"[LEFT]...

C7  5160 IFM=1THENPRINTP$:R=D:FO
    RF=0TOG-1:POKE1008+F,PEEK(C+
    F):NEXT:N=N+(N>0)
33  5170 IFM=1THENM=0:FORF=CTOE:
    POKEF,PEEK(F+G):NEXT:E=E-G:C
    =C+G*(C>AANDC=E)
65  5180 IFN=0THENPRINTM$R$E$R$"
    [DOWN]";:FORF=0TOG:PRINTE$:N
    EXT
5F  5190 H=S:RETURN
35  6000 POKEB+11,33:FORV=0TO299
    :NEXT:POKEB+11,32:RETURN
C6  7000 B$="":V=D:IFH=0THENB$=S
    TR$(D):B$=RIGHT$(B$,LEN(B$)-
    1):GOTO7020
C9  7010 FORK=1TOL:V%=V/16↑(L-K)
    :B$=B$+CHR$(V%+48-7*(V%>9)):
    V=V-V%*16↑(L-K):NEXT
16  7020 IFL=4THENPRINT" ";:IFH=
    1THENPRINT"$";
11  7030 PRINTB$"[SPC3,LEFT3]";:
    K=0:RETURN
```

PROGRAM: DATA LOADER C128

```
10 bank1:poke57,0:poke58,8:clr:b
=65278:r$=chr$(13):vol15:scnclr:
ifpeek(215)=0thencolor0,2:color4
,16:elsecolor6,2:window20,0,59,2
4
20 print"(down)(swlc)($11)(pur)
   D A T A   L O A D E R   1 2
8"r$tab(14)"(down)(red)Designed
By"r$tab(14)"(down)(blu)D. R. Mu
rr."r$"(down)(gry3)--------------
-----------------------------
30 d$=chr$(20):e$=chr$(27):n$="(
home)(down)"+e$+"q(down)"+e$+"q(
home)(down)(lblu) ":p$="(grn)Ple
ase Wait...(up)":s$="(lblu) Pres
s 'Space'..."
40 m$="(home)(down)(lblu) (rvs)E
(off)nter  (rvs)M(off)odify  (rv
s)N(off)ext  (rvs)P(off)revious
 (rvs)G(off)oto"+r$+" (rvs)I(off
)nsert  (rvs)D(off)elete  (rvs)R
(off)ecover  (rvs)S(off)ave  (rv
s)Q(off)uit"
50 dima,c,d,e,f,g,h,k,l,m,n,q,r,
s,a$,b$,c$,a$(1),h$(1),n$(1),m$(
2):fora=0to1:reada$(a),h$(a),n$(
a):next:fora=0to2:readm$(a):next
60 data2049-65262,"Decimal",,$08
01-$feee,"Hex ($)","s","Goto","D
elete","Insert"
70 print"(home)(down)(down)(down
)(down)(down)(down)(down)(down)(
blk)Load File (y/n)? "e$"@";:do:
getkeyc$:loopuntilc$="y"orc$="n"
:printc$r$r$:ifc$="y"thengosub20
00:goto170
80 print"(up)Block Size (8-16)?
";:l=2:gosub1000:ifd<8ord>16then
gosub6000:goto80
90 g=d:print"(down)(rvs)H(off)ex
 or (rvs)D(off)ecimal? ";:do:get
keyc$:loopuntilc$="d"orc$="h":pr
intc$r$r$:h=-(c$="h")
100 print"(up)Start Address ("a$
(h)")? "e$"q";:l=5-h:gosub1000:i
fd<2049ord>b-16thengosub6000:got
o100
110 a=d:c=d:e=d:print"(down)All
Correct (y/n)?":do:getkeyc$:loop
untilc$="y"orc$="n":ifc$="n"then
70
120 p$=" "+p$:print"(clr)(gry3)(
rvs)-----------------------------
--------------(off)"m$r$"(down)(gr
y3)-(rvs)ADDRESS(off)--(rvs)DATA
(off)-------------------------
130 gosub3000
140 getkeyc$:ifc$="e"then130:els
eifc$="r"thengosub5000:goto130:e
lseifc$="q"then160:elseifn=0then
140:elseifc$="m"or(c$="n"andc<e)
then130
150 ifc$="p"andc-g>athenc=c-2*g:
goto130:elseifc$="s"thengosub400
0:goto140:elseifc$="g"orc$="i"or
c$="d"thengosub5000:goto130:else
140
160 printn$"Quit Program (y/n)?"
:do:getkeyc$:ifc$="n"thenprintm$
:goto140:elseifc$="y"then180:els
eloop
170 print"(down)(rvs)C(off)ontin
ue (rvs)E(off)nd?":do:getkeyc$:i
fc$="c"then120:elseifc$<>"e"then
loop
180 color0,12:color4,14:color6,1
:bank15:sys65409:end
1000 print"(rvs) (off)  (left)(l
eft)(left)";
1010 getkeyc$:ifc$=e$andq=1then1
040:elseifc$=d$andk>0thenk=k-1:b
$=left$(b$,k):print"(left)";:got
o1000:elseifc$=r$andk>0then1030:
elseifk=lthen1010
1020 d=asc(c$+chr$(0))-48:if(h=0
and(d<0ord>9))or(h=1and(d<0or(d>
9andd<17)ord>22))then1010:elseb$
=b$+c$:printc$;:k=k+1:ifk<=lthen
1000
1030 print" ":ifh=0thend=val(b$)
:elsed=dec(b$)
1040 k=0:q=0:b$="":return
2000 trap2030:do:a$="":input"(up
)File Name";a$:iflen(a$)=0orlen(
a$)>16thengosub6000:loop
2010 printr$p$:bload(a$),b1:trap
:a=peek(172)+256*peek(173):e=pee
k(174)+256*peek(175)-1:g=peek(e)
and31:h=(peek(e)and32)/32:c=e-g:
n=(e-a)/g:l=4
2020 print"(blk)Block Size ="g;r
$"(down)Mode = "h$(h)r$"(down)St
art Address =";:d=a:gosub7000:pr
intr$"(down)Next Address =";:d=e
:gosub7000:printr$"(down)Blocks
Done ="n:return
2030 gosub6000:printmid$(ds$,4,l
en(ds$)-9)"!"r$"(down)(blk)Try A
gain (y/n)?":do:getkeyc$:ifc$="y
"thenprint""E$"@";:RESUME2000:EL
SEIFC$="N"THEN180:ELSELOOP
3000 ifc$="e"ande+g>bthengosub60
00:printn$"(grn)Out Of Memory!"r
$s$:do:getkeyc$:loopuntilc$=" ":
goto3080
3010 ifc$="e"thenc=e:m=2:n=n+1:p
rintn$"Enter New Block...":elsei
fm=3orn=0then3080:elseifc$="m"th
enc=c-g:m=1:printn$"Modify This
Block...
3020 print"(home)(down)(down)(do
wn)(lred) Block"(c-a)/g+1"(left)
  (left)of"n"(left) Block"n$(-(n
>1))"  (blk)"r$:ifm=2thenprinte$
"@";
3030 s=0:forf=1tog:d=c:l=4:gosub
7000:b$="":print,
3040 ifm<2thend=peek(c):l=2:gosu
b7000:ifm=1thenk=2*h+(1-h)*(1-(d
>9)-(d>99))
3050 ifm=0then3070
3060 l=3-h:gosub1000:print"(up)"
,:ifd>255thengosub6000:goto3040:
elsepokec,d:l=2:gosub7000
3070 print:c=c+1:s=s+d:next:prin
t" Checksum =";:l=4:d=s:gosub700
0:print"(wht)"fre(1):ifm>0thenso
und1,18000,10
3080 printm$:e=e-g*(c>e):k=0:m=0
:b$="":return
4000 printn$"Save Block"n$(-(n>1
))" (y/n)?(up)":do:getkeyc$:ifc$
="n"then4070:elseifc$<>"y"thenlo
op
4010 pokee,g+32*h:do:printn$"Fil
e Name  "a$r$"(up)",:inputb$:ifl
en(b$)=0orlen(b$)>16thengosub600
0:loop
4020 printp$:bsave(b$),b1,p(a)to
p(e+1):a$=b$:c$=" "+mid$(ds$,4,l
en(ds$)-9)+"! (lblu)":ifds<>63th
en4040
4030 gosub6000:printc$"Overwrite
 (y/n)?(up)":do:getkeyc$:ifc$="y
"thenb$="@"+b$:printe$"q";:goto4
020:elseifc$<>"n"thenloop
4040 ifds<20ords=63then4060
4050 gosub6000:printc$"Try Again
 (y/n)?":do:getkeyc$:ifc$="y"the
n4010:elseifc$<>"n"thenloop
4060 ifleft$(a$,1)="@"thena$=rig
ht$(a$,len(a$)-1)
4070 printm$:return
5000 if(c$="i"or(c$="r"andr>0))a
nde+g>bthenc$="e":return
5010 s=h:h=0:l=3:m=-(c$="d")-2*(
c$="i")-3*(c$="r"):printn$;:ifm<
```

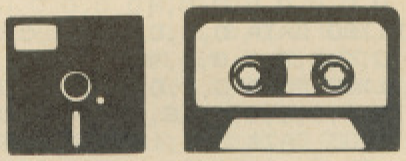
```
3then5040
5020 ifr=0thengosub6000:print"(g
rn)No Block to Recover!"r$s$:do:
getkeyc$:loopuntilc$=" ":goto509
0
5030 print"Recover Block"r"(left
) (y/n)?":do:getkeyc$:ifc$="y"th
end=r:r=0:goto5050:elseifc$="n"t
hen5090:elseloop
5040 print"(home)(down) "m$(m)"
Block ((rvs)ESC(off)=Abort)? ";:
q=1:gosub1000:ifc$=e$thenm=3:got
o5090:elseifd<1ord>nthengosub600
0:goto5040
5050 c=a+(d-1)*g:ifm>1thenprintp
$:forf=etocstep-1:pokef+g,peek(f
):next:e=e+g:n=n+1:ifm=3thenm=0:
forf=0tog-1:pokec+f,peek(65500+f
):next
5060 ifm=2thenprintn$m$(m)" Bloc
k"(c-a)/g+1"(left)...
5070 ifm=1thenprintp$:r=d:forf=0
tog-1:poke65500+f,peek(c+f):next
:forf=ctoe:pokef,peek(f+g):next:
e=e-g:c=c+g*(c>aandc=e):m=0:n=n+
(n>0)
5080 ifn=0thenprintm$r$e$"q(down
)(down)"e$"@
5090 h=s:return
6000 sound1,2000,20,,,,1:return
7000 b$="":ifh=0thenb$=str$(d):b
$=right$(b$,len(b$)-1):elseb$=ri
ght$(hex$(d),1)
7010 ifl=4thenprint" ";:ifh=1the
nprint"$";
7020 printb$"    (left)(left)(lef
t)";:return
```

PROGRAM: 64 DATA PROG

```
c2  10 a=53280:pokea,15:pokea+1,
    1:print"[clr,rev n,rev h,dow
    n,purple]64 [sd,sa,st,sa] [s
    l,so,sa,sd,se,sr] [st,so] [s
    p,sr,so,sg,sr,sa,sm] [sf,si,
    sl,se] [sc,so,sn,sv,se,sr,st
    ,se,sr]
2c  20 o$=chr$(0):r$=chr$(13):pr
    inttab(14)"[red,sd]esigned [
    sb]y"r$tab(14)"[down,blue,sd
    ]. [sr]. [sm,su,sr2].[black]
    "r$r$
a0  30 dima,b,c,d:p$="[down,gree
    n,sp]lease [sw]ait...":s$="[
    up,spc34,up2]"
88  40 a$="":input"[up,black,sf]
    ile [sn]ame";a$:iflen(a$)=0o
    rlen(a$)>16then40
80  50 open15,8,15,"i":open1,8,8
    ,"0:"+a$+",p,r":input#15,d,d
    $:close1:close15
c1  60 ifd<20then110
b8  70 print"[down,green]"d$"! [
    c7,st]ry [sa]gain (y/n)?
43  80 getd$:ifd$="n"thenend
82  90 ifd$="y"thenprints$:goto4
    0
15  100 goto80
5b  110 printp$:open1,8,8,a$+",p
    ,r":get#1,b$,c$,d$,e$:b=asc(
    b$+o$):c=asc(c$+o$)
55  120 a=b+256*c:e=asc(d$+o$)+2
    56*asc(e$+o$):ford=atoe:get#
    1,d$:poked,asc(d$+o$)
1c  130 next:close1:a$=left$(a$,
    15)+"&"
37  140 print"[up,black,ss]tart
    [sa]ddress "a:r$"[up]"tab(13
    );:inputd$:d=val(d$)
4b  150 ifd<2049ord>53247then140

63  160 c=int(d/256):b=d-256*c:p
    rintr$
77  170 print"[up,black,ss]aving
     as  "a$r$"[up]"tab(9);:inpu
    tb$:iflen(b$)=0orlen(b$)>16t
    hen170
fc  180 a$=b$:open15,8,15,"i":op
    en1,8,8,"0:"+a$+",p,w":input
    #15,d,d$:close1:close15
9d  190 ifd<>63then240
06  200 print"[down,green]"d$"!
    [c7,so]verwrite (y/n)?
4e  210 getd$:ifd$="n"thenprints
    $:goto170
27  220 ifd$="y"thenprints$:goto
    290
c0  230 goto210
f0  240 ifd<20then290
5c  250 print"[down,green]"d$"!
    [c7,st]ry [sa]gain (y/n)?
18  260 getd$:ifd$="n"thenend
c5  270 ifd$="y"thenprints$:goto
    170
24  280 goto260
b3  290 printp$:open1,8,8,"@0:"+
    a$+",p,w":print#1,chr$(b)chr
    $(c);
02  300 ford=atoe:print#1,chr$(p
    eek(d));:next:close1:prints$
    r$"[down,black,sd]one!
```

Sprite Library



PROGRAM: BIRD FLIGHT DATA

```
AF  10 REM**********************
    *
4B  20 REM*   SPRITE LIRBARY
    *
A3  30 REM*   --------------
    *
F2  40 REM*  BIRD FLIGHT DATA
    *
CE  50 REM*  BASIC DATA LOADER
    *
99  60 REM* SPRITES DESIGNED BY
    *
2E  70 REM*       MIKE BENN
    *
C5  80 REM**********************
    *
DD  90 BL=255  :LN=190  :SA=1024
    0
89  100 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15
4F  110 READ A:IF A>255THENPRINT
    "NUMBER TO LARGE";LN+(L*10):
    STOP
98  120 CX=CX+A:POKE SA+L*16+D,A
    :NEXT D
D9  130 READ A:IF A<>CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
37  140 NEXTL:POKE43,0:POKE44,40
    :POKE45,0:POKE46,56
30  150 SAVE"BIRD FLIGHT",8,1:EN
    D
EF  160 REM*********************
    ***********
3B  170 REM TAPE USERS WILL NEED
     TO CHANGE          DEVICE N
    UMBER FROM 8 TO 1
FB  180 REM*********************
    ***********
2D  190 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,1,0,0,1
72  200 DATA 5,64,0,5,80,0,21,16
    ,0,86,0,0,86,0,1,90,454
D0  210 DATA 0,1,88,0,5,104,0,5,
    96,0,5,160,0,21,128,0,613
1A  220 DATA 20,128,0,16,48,0,0,
    0,0,0,0,0,0,0,0,0,212
78  230 DATA 0,0,0,0,0,0,0,5,0,0
    ,21,64,0,85,80,0,255
44  240 DATA 85,16,1,86,0,1,90,0
    ,5,90,0,5,104,0,5,104,592
5D  250 DATA 0,5,160,0,5,160,0,2
    1,128,0,20,128,0,16,128,0,77
    1
EE  260 DATA 0,48,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,48
F9  270 DATA 0,0,0,0,0,0,0,0,0,0
    ,85,0,1,85,64,1,236
18  280 DATA 85,80,1,85,16,5,86,
    0,5,90,0,5,88,0,5,104,655
72  290 DATA 0,5,96,0,5,160,0,21
    ,128,0,20,128,0,19,0,0,582
BE  300 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
A4  310 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
32  320 DATA 0,0,0,0,0,0,21,80,0
    ,86,148,1,90,132,5,90,653
81  330 DATA 0,5,104,0,21,104,0,
    21,160,0,22,128,0,12,0,0,577

10  340 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,52,52
8C  350 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
5E  360 DATA 0,0,0,0,0,0,0,0,5,8
    5,64,21,85,84,85,85,514
F9  370 DATA 85,58,170,129,0,170
    ,0,0,0,0,0,0,0,0,0,0,612
C8  380 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,13,13
D4  390 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
15  400 DATA 0,0,0,85,0,1,85,64,
    5,85,64,21,85,84,86,170,835
BE  410 DATA 149,58,170,129,0,17
    0,0,0,0,0,0,0,0,0,0,0,676
C6  420 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,8,8
24  430 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,84,0,0,84
47  440 DATA 85,0,1,85,0,1,85,64
    ,5,85,64,21,85,84,86,170,921

C6  450 DATA 149,58,170,129,0,17
    0,0,0,0,0,0,0,0,0,0,0,676
66  460 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,247,247
54  470 DATA 0,0,0,0,0,0,0,80,0,
    0,84,0,0,84,0,1,249
0F  480 DATA 85,0,1,85,0,1,85,64
    ,5,85,64,21,85,84,86,170,921

EE  490 DATA 149,58,170,129,0,17
    0,0,0,0,0,0,0,0,0,0,0,676
B0  500 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,195,195
54  510 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,84,0,0,84
AC  520 DATA 85,0,1,85,0,1,85,64
    ,5,85,64,21,85,84,86,170,921

8D  530 DATA 149,58,170,129,0,17
    0,0,0,0,0,0,0,0,0,0,0,676
D3  540 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,13,13
BB  550 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
76  560 DATA 0,0,0,85,0,1,85,64,
    5,85,64,21,85,84,86,170,835
35  570 DATA 149,58,170,129,0,17
    0,0,0,0,0,0,0,0,0,0,0,676
9D  580 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,5,5
83  590 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
```

```
35   600 DATA 0,0,0,0,0,0,0,0,5,8
     5,64,21,85,84,85,85,514
28   610 DATA 85,58,170,129,0,170
     ,0,0,0,0,0,0,0,0,0,0,612
55   620 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,255,255
EB   630 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
69   640 DATA 0,0,0,0,0,0,0,0,21,
     85,84,85,85,85,5,85,535
0E   650 DATA 65,0,170,0,0,0,0,0,
     0,0,0,0,0,0,0,0,235
53   660 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,57,57
33   670 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
15   680 DATA 0,0,0,0,0,21,85,84,
     85,85,85,5,85,65,1,85,686
FC   690 DATA 64,0,85,0,0,0,0,0,0
     ,0,0,0,0,0,0,0,149
0D   700 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,52,52
1B   710 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
20   720 DATA 0,0,0,0,0,21,85,84,
     85,85,85,5,85,81,1,85,702
6E   730 DATA 64,1,85,64,0,85,0,0
     ,84,0,0,0,0,0,0,0,383
A5   740 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,52,52
63   750 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
98   760 DATA 0,0,0,0,0,21,85,84,
     85,85,85,5,85,81,1,85,702
1E   770 DATA 64,1,85,64,0,85,0,0
     ,85,0,0,21,0,0,0,0,405
BC   780 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,203,203
4A   790 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
2F   800 DATA 0,0,0,0,0,21,85,84,
     85,85,85,5,85,81,1,85,702
18   810 DATA 64,1,85,64,0,85,64,
     0,85,64,0,21,0,0,5,0,538
F5   820 DATA 0,5,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,255,260
92   830 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
A7   840 DATA 0,0,0,0,0,21,85,84,
     85,85,85,5,85,81,1,85,702
2E   850 DATA 64,1,85,64,0,85,0,0
     ,85,0,0,21,0,0,0,0,405
22   860 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,57,57
FA   870 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
9F   880 DATA 0,0,0,0,0,21,85,84,
     85,85,85,5,85,81,1,85,702
91   890 DATA 64,1,85,64,0,85,0,0
     ,84,0,0,0,0,0,0,0,383
34   900 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,49,49
C2   910 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
AC   920 DATA 0,0,0,0,0,21,85,84,
     85,85,85,5,85,65,1,85,686
4D   930 DATA 64,0,85,0,0,0,0,0,0
     ,0,0,0,0,0,0,0,149
84   940 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,255,255
2A   950 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
4A   960 DATA 0,0,0,0,0,0,0,0,21,
     85,84,85,85,85,5,85,535
4D   970 DATA 65,0,170,0,0,0,0,0,
     0,0,0,0,0,0,0,0,235
A6   980 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,58,58
72   990 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0
61   1000 DATA 0,0,0,0,0,0,0,0,5,
     85,80,21,85,84,5,85,450
0B   1010 DATA 68,0,170,0,0,0,0,0
     ,0,0,0,0,0,0,0,0,238
6C   1020 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,3,3
59   1030 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
27   1040 DATA 0,0,0,0,0,1,85,64,
     5,85,80,5,85,80,10,170,670
9D   1050 DATA 144,0,170,16,0,0,0
     ,0,0,0,0,0,0,0,0,0,330
01   1060 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,252,252
A1   1070 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
C2   1080 DATA 0,0,0,0,0,1,81,64,
     5,85,80,21,85,84,2,170,678
5D   1090 DATA 80,0,170,64,0,0,0,
     0,0,0,0,0,0,0,0,0,314
9B   1100 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,7,7
89   1110 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
7E   1120 DATA 0,0,0,0,0,5,80,84,
     21,85,85,1,85,80,0,41,567
85   1130 DATA 128,0,9,128,0,0,0,
     0,0,0,0,0,0,0,0,0,265
E3   1140 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,4,4
D1   1150 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
86   1160 DATA 0,0,16,0,1,21,64,8
     5,5,85,84,1,85,80,0,38,565
65   1170 DATA 0,0,4,0,0,0,0,0,0,
     0,0,0,0,0,0,0,4
CB   1180 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,4,4
59   1190 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,16,16
B2   1200 DATA 0,1,16,0,1,4,0,4,5
     ,64,84,1,81,80,0,85,426
B9   1210 DATA 64,0,38,0,0,4,0,0,
     0,0,0,0,0,0,0,0,106
1B   1220 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
F8   1230 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,16,0,1,16,33
74   1240 DATA 0,1,4,0,4,1,0,16,1
     ,64,80,0,81,64,0,85,401
B1   1250 DATA 64,0,38,0,0,4,0,0,
     0,0,0,0,0,0,0,0,106
63   1260 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
49   1270 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,16,16
85   1280 DATA 0,1,16,0,1,4,0,4,5
     ,64,84,1,81,80,0,85,426
2A   1290 DATA 64,0,38,0,0,4,0,0,
     0,0,0,0,0,0,0,0,106
BE   1300 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,67,67
B0   1310 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
8D   1320 DATA 0,0,16,0,1,21,64,8
     5,5,85,84,1,85,80,0,38,565
C4   1330 DATA 0,0,4,0,0,0,0,0,0,
     0,0,0,0,0,0,0,4
92   1340 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
98   1350 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
43   1360 DATA 0,0,0,0,0,0,0,0,21
     ,85,85,1,85,80,0,38,395
8C   1370 DATA 0,0,4,0,0,0,0,0,0,
     0,0,0,0,0,0,0,4
42   1380 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,251,251
E0   1390 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
F3   1400 DATA 0,0,0,0,0,0,85,64,
     5,85,84,17,102,81,0,4,527
D4   1410 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
C2   1420 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
C8   1430 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
3A   1440 DATA 0,0,0,0,0,0,21,0,1
     ,85,80,5,102,84,16,4,398
3C   1450 DATA 1,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,1
5E   1460 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,67,67
10   1470 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
72   1480 DATA 0,0,0,0,0,0,21,0,1
     ,85,80,5,102,84,5,4,387
4E   1490 DATA 20,20,0,5,0,0,0,0,
     0,0,0,0,0,0,0,0,45
96   1500 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,67,67
78   1510 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
74   1520 DATA 0,0,0,21,0,1,85,80
     ,5,102,84,5,68,84,5,0,540
94   1530 DATA 20,1,0,16,0,0,0,0,
     0,0,0,0,0,0,0,0,37
B9   1540 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,188,188
47   1550 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
91   1560 DATA 0,0,0,21,0,1,85,80
     ,5,102,84,5,85,84,5,81,638
63   1570 DATA 84,1,64,80,0,64,64
     ,0,0,0,0,0,0,0,0,0,357
C7   1580 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,71,71
AF   1590 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
02   1600 DATA 0,0,0,21,0,0,85,64
     ,1,102,80,5,85,84,5,64,596
0F   1610 DATA 84,5,0,20,4,0,4,0,
     0,0,0,0,0,0,0,0,117
81   1620 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,4,4
F7   1630 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
F5   1640 DATA 0,0,0,0,0,0,21,0,1
     ,85,80,5,102,84,5,4,387
6B   1650 DATA 20,4,0,4,0,0,0,0,0
     ,0,0,0,0,0,0,0,28
37   1660 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,71,71
DF   1670 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
A7   1680 DATA 0,0,0,0,0,0,21,0,1
     ,85,80,5,102,84,16,4,398
33   1690 DATA 1,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,1
81   1700 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,255,255
27   1710 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
60   1720 DATA 0,0,0,0,0,0,85,64,
     5,85,84,17,102,81,0,4,527
1B   1730 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
71   1740 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,251,251
0F   1750 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
06   1760 DATA 0,0,0,0,0,0,0,0,21
     ,85,85,1,85,80,0,38,395
C3   1770 DATA 0,0,4,0,0,0,0,0,0,
     0,0,0,0,0,0,0,4
69   1780 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,3,3
57   1790 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
0F   1800 DATA 0,0,16,0,1,21,64,8
     5,5,85,84,1,85,80,0,38,565
4A   1810 DATA 0,0,4,0,0,0,0,0,0,
     0,0,0,0,0,0,0,4
B0   1820 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
D0   1830 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,16,16
4F   1840 DATA 0,1,16,0,1,4,0,4,5
     ,64,84,1,81,80,0,85,426
50   1850 DATA 64,0,38,0,0,4,0,0,
     0,0,0,0,0,0,0,0,106
```

```
E4  1860 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,67,67
95  1870 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,16,0,1,16,33
7D  1880 DATA 0,1,4,0,4,1,0,16,1
    ,64,80,0,81,64,0,85,401
08  1890 DATA 64,0,38,0,0,4,0,0,
    0,0,0,0,0,0,0,0,106
68  1900 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,184,184
C0  1910 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,16,16
02  1920 DATA 0,1,20,0,5,5,0,20,
    5,64,80,1,81,80,0,85,447
40  1930 DATA 64,0,38,0,0,4,0,0,
    0,0,0,0,0,0,0,0,106
90  1940 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,184,184
36  1950 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
7F  1960 DATA 0,0,20,0,5,21,0,21
    ,5,64,84,5,81,80,1,85,472
19  1970 DATA 80,0,102,64,0,38,0
    ,0,8,0,0,0,0,0,0,0,292
98  1980 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,184,184
1E  1990 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
97  2000 DATA 0,0,20,0,5,21,0,21
    ,5,64,84,5,85,80,1,85,476
97  2010 DATA 80,0,102,64,0,106,
    64,0,8,0,0,8,0,0,0,0,432
C0  2020 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,184,184
96  2030 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,20,20
EF  2040 DATA 0,5,21,0,21,5,68,8
    4,5,68,84,1,85,80,1,89,617
6F  2050 DATA 80,0,106,64,0,106,
    64,0,42,0,0,42,0,0,8,0,512
26  2060 DATA 0,8,0,0,0,0,0,0,0,
    0,0,0,0,0,0,184,192
D1  2070 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,20,20
74  2080 DATA 0,5,21,0,21,5,68,8
    4,5,68,84,1,85,80,1,89,617
0E  2090 DATA 80,0,106,64,0,106,
    64,0,42,0,0,42,0,0,42,0,546
C0  2100 DATA 0,8,0,0,8,0,0,51,0
    ,0,0,0,0,0,0,184,251
95  2110 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
C5  2120 DATA 0,0,4,0,4,5,4,20,1
    ,68,80,1,85,80,1,89,442
E6  2130 DATA 80,0,106,64,0,106,
    64,0,42,0,0,42,0,0,42,0,546
68  2140 DATA 0,8,0,0,8,0,0,51,0
    ,0,0,0,0,0,0,184,251
FD  2150 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
63  2160 DATA 0,0,0,0,0,0,4,0,0,
    4,0,0,21,0,0,89,118
13  2170 DATA 64,0,89,64,0,89,64
    ,0,89,64,0,25,0,0,42,0,590
50  2180 DATA 0,8,0,0,8,0,0,51,0
    ,0,0,0,0,0,0,184,251
C5  2190 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
CB  2200 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,4,4
39  2210 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
47  2220 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,94,94
2D  2230 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
05  2240 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,21,21
E1  2250 DATA 0,0,4,0,0,0,0,0,0,
    0,0,0,0,0,0,0,4
D7  2260 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,126,126
75  2270 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
B5  2280 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,85,85
D5  2290 DATA 64,0,4,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,68
B9  2300 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,199,199
5C  2310 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
1C  2320 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,17,0,0,85,102
0C  2330 DATA 64,0,4,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,68
D0  2340 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,57,57
A4  2350 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
4B  2360 DATA 0,0,0,0,0,0,0,0,0,
    0,0,1,81,80,0,21,183
98  2370 DATA 0,0,4,0,0,0,0,0,0,
    0,0,0,0,0,0,0,4
28  2380 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,16,16
8C  2390 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
74  2400 DATA 0,0,0,0,0,0,0,0,5,
    64,84,0,81,64,0,21,319
40  2410 DATA 0,0,4,0,0,0,0,0,0,
    0,0,0,0,0,0,0,4
46  2420 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,184,184
D4  2430 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
42  2440 DATA 0,0,0,0,0,5,0,20,1
    ,64,80,0,81,64,0,85,400
6E  2450 DATA 64,0,38,0,0,4,0,0,
    0,0,0,0,0,0,0,0,106
50  2460 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,94,94
3C  2470 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
A6  2480 DATA 0,0,20,0,5,1,0,16,
    1,64,80,0,81,64,0,85,417
86  2490 DATA 64,0,38,0,0,4,0,0,
    0,0,0,0,0,0,0,0,106
6A  2500 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,168,168
13  2510 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,16,0,1,16,33
4F  2520 DATA 0,1,4,0,4,1,0,16,1
    ,64,80,0,81,64,0,85,401
DE  2530 DATA 64,0,38,0,0,4,0,0,
    0,0,0,0,0,0,0,0,106
EA  2540 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,129,129
4A  2550 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,16,16
40  2560 DATA 0,1,16,0,1,4,0,4,5
    ,64,84,1,81,80,0,85,426
C3  2570 DATA 64,0,38,0,0,4,0,0,
    0,0,0,0,0,0,0,0,106
31  2580 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,129,129
E3  2590 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,20,20
29  2600 DATA 0,5,5,0,20,5,80,84
    ,1,85,80,0,85,64,0,41,555
CB  2610 DATA 128,0,9,128,0,0,0,
    0,0,0,0,0,0,0,0,0,265
1D  2620 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,235,235
83  2630 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
A7  2640 DATA 0,0,5,64,84,1,81,8
    0,5,85,80,21,85,64,2,170,827

62  2650 DATA 64,0,170,64,0,0,0,
    0,0,0,0,0,0,0,0,0,298
1B  2660 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,83,83
EB  2670 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
A0  2680 DATA 0,0,0,0,0,0,0,0,5,
    85,80,21,85,84,5,85,450
9C  2690 DATA 68,0,170,0,0,0,0,0
    ,0,0,0,0,0,0,0,0,238
93  2700 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,252,252
33  2710 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
C1  2720 DATA 0,0,0,0,0,0,0,0,21
    ,85,84,85,85,85,5,85,535
D6  2730 DATA 65,0,170,0,0,0,0,0
    ,0,0,0,0,0,0,0,0,235
2D  2740 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
```

PROGRAM: BIRD FLIGHT DISPLAY

```
85  10 REM**************************
    ****
31  20 REM* SPRITE LIRBARY DISPL
    AY *
9E  30 REM*       BIRD FLIGHT
       *
CB  40 REM**************************
    ****
CA  50 POKE55,0:POKE56,40:X=X+1:
    IFX=1THENLOAD"BIRD FLIGHT",8
    ,1
E9  60 P0=70:P1=150:P2=118:P3=15
    0:P4=180:P5=150:P6=248:P7=15
    0:S=160:E=199:D=250
F8  70 V=53248:PRINT"[CLS][WHT][
    26CD][9CR][REV]F7 TO STOP AN
    IMATION"
84  80 POKEV+21,15:POKEV+23,10:P
    OKEV+28,15:POKEV+29,12:POKEV
    +32,3:POKEV+33,3
68  90 POKEV+37,0:POKEV+38,07:PO
    KEV+39,7:POKEV+40,7:POKEV+41
    ,7:POKEV+42,7:POKEV,P0
B7  100 POKEV+1,P1:POKEV+2,P2:PO
    KEV+3,P3:POKEV+4,P4:POKEV+5,
    P5:POKEV+6,P6:POKEV+7,P7
27  110 INPUT"[HOM][CD]START SPR
    ITE";S:INPUT"END SPRITE";E:I
    NPUT"DELAY";D
D2  120 FORSP=STOE:FORT=OTOD:NEX
    T:PRINT"[HOM]"TAB(23)"SPRITE
     NO.=";SP:POKE2040,SP
72  130 POKE2041,SP:POKE2042,SP:
    POKE2043,SP:NEXT:GETK$:IFK$=
    "[F7]"THEN110
34  140 GOTO120
```

Playing the Game

PROGRAM: FRUIT MACHINE

```
>1000 00 0B 10 00 00 9E 34 31
>1008 30 39 00 00 00 4C 52 1D
>1010 A2 00 A0 00 B1 D0 91 D2
>1018 B1 D4 91 D6 C8 C0 04 D0
>1020 F3 18 A5 D0 69 04 85 D0
>1028 90 02 E6 D1 18 A5 D2 69
>1030 28 85 D2 90 02 E6 D3 18
>1038 A5 D4 69 04 85 D4 90 02
>1040 E6 D5 18 A5 D6 69 28 85
>1048 D6 90 02 E6 D7 E8 EC FE
>1050 07 D0 BF 60 BD 38 12 85
>1058 D0 BD 4F 12 85 D1 B9 03
>1060 13 85 D2 B9 08 13 85 D3
>1068 BD 63 12 85 D4 BD 77 12
>1070 85 D5 A5 D2 85 D6 38 A5
>1078 D3 E9 04 85 D7 6C E7 00
>1080 BD 8B 12 85 D0 BD 4F 12
>1088 85 D1 B9 0D 13 85 D2 B9
>1090 08 13 85 D3 BD 9F 12 85
```

```
>1098 D4 BD B3 12 85 D5 A5 D2
>10A0 85 D6 38 A5 D3 E9 04 85
>10A8 D7 6C E7 00 BD C7 12 85
>10B0 D0 BD 4F 12 85 D1 B9 12
>10B8 13 85 D2 B9 17 13 85 D3
>10C0 BD D8 12 85 D4 BD EF 12
>10C8 85 D5 A5 D2 85 D6 38 A5
>10D0 D3 E9 04 85 D7 6C E7 00
>10D8 A5 D8 85 DB A9 00 85 DC
>10E0 85 DD A9 02 8D FE 07 A6
>10E8 D8 A4 DD 20 FC 11 E6 DD
>10F0 E6 D8 A5 D8 C9 14 D0 02
>10F8 A9 00 85 D8 A6 D8 A4 DD
>1100 A9 04 8D FE 07 20 E1 11
>1108 E6 DC A5 DC C9 03 D0 DE
>1110 E6 DD E6 D8 A5 D8 C9 14
>1118 D0 02 A9 00 85 D8 A6 D8
>1120 A4 DD A9 02 8D FE 07 20
>1128 E1 11 A5 DB 85 D8 60 A5
>1130 D9 85 DB A9 00 85 DC 85
>1138 DD A9 02 8D FE 07 A6 D9
>1140 A4 DD 20 07 12 E6 DD E6
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>3858 A9 20 20 20 20 B9 BA BB
>3860 BC BD BE BF C0 C1 C2 C3
>3868 20 20 20 20 20 AE AF B0
>3870 B1 B2 B3 B4 B5 20 20 20
>3878 20 C4 C5 C6 C7 C8 C9 CA
>3880 CB CD CE CF D0 D1 D2 D3
>3888 D4 D5 D6 D7 D8 D9 DA DB
>3890 DC DD DE DF E0 E1 E2 E3
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>38C0 6F 6F 6F 6F 6F 6F 6F 6F
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>38F8 3A 2C 2C 2C 2C 2C 2C 2C
>3900 2C 2C 2C 2C 2C 2C 2C 2C
>3908 2C 57 57 57 57 57 57 57
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May I Interrupt?

PROGRAM: SPRITELY BORDERS

```
F2  1 REM ENTER AND SAVE THIS PR
    OGRAM.
7F  2 REM IT CREATES A FILE NAME
    D 'BORDER SPRITES'.
55  3 REM BEFORE IT IS SAVED, A
    PROMPT WILL INVITE YOU TO EN
    TER THE DEVICE NUMBER.
18  4 REM ENSURE THAT THE DISK/T
    APE IN THE DEVICE IS THE ONE
     FOR THE FINAL PROGRAM.
49  5 REM WHEN 'BORDER SPRITES'
    HAS BEEN SAVED, THIS LOADER
    PROGRAM IS REDUNDANT.
33  6 REM CARTRIDGES MAY PREVENT
     THE PROGRAM FROM RUNNING PR
    OPERLY.
76  7 REM LOAD 'BORDER SPRITES'
    AND ACTIVATE WITH SYS49152.
C4  10 BL=116:LN=50:SA=38912
F9  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15
4F  21 READ A:CX=CX+A:POKE SA+L*
    16+D,A:POKE53280,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
16  40 NEXT L:SYS40576
6D  50 DATA 20,8,195,7,158,50,48
    ,55,52,32,84,85,82,66,79,45,
    1066
B4  60 DATA 56,55,0,0,0,170,170,
    170,170,32,68,229,169,14,141
    ,32,1476
67  70 DATA 208,141,33,208,120,1
    69,52,133,1,162,5,189,94,8,1
    57,45,1725
ED  80 DATA 0,202,16,247,154,160
    ,0,198,50,206,65,8,177,49,15
    3,0,1685
1E  90 DATA 0,230,1,141,24,212,1
    98,1,200,208,241,165,50,201,
    8,208,2088
EE  100 DATA 230,185,100,8,153,0
    ,1,200,208,247,76,0,1,0,192,
    216,1817
D4  110 DATA 250,129,14,177,47,4
    2,42,42,42,41,7,170,189,26,1
    ,141,1360
C0  120 DATA 24,1,177,47,41,31,1
    70,32,34,1,76,255,1,168,74,1
    75,1307
49  130 DATA 125,92,66,70,48,230
    ,1,238,32,208,198,1,230,47,2
    08,2,1796
BC  140 DATA 230,48,96,177,47,32
    ,34,1,145,45,230,45,208,2,23
    0,46,1616
E2  150 DATA 202,208,245,240,190
    ,169,0,240,239,169,255,208,2
    35,177,47,145,2969
20  160 DATA 45,32,34,1,230,45,2
    08.2,230,46,202,208,240,240,
    164,32,1959
AE  170 DATA 117,1,177,47,32,34,
    1,145,45,230,45,208,2,230,46
    ,202,1562
4F  180 DATA 208,245,198,57,16,2
    41,48,139,134,57,177,47,170,
    76,34,1,1848
16  190 DATA 32,117,1,177,47,145
    ,45,32,34,1,230,45,208,2,230
    ,46,1392
77  200 DATA 202,208,240,198,57,
    16,236,76,0,1,44,222,1,169,5
    5,133,1858
C7  210 DATA 1,88,234,234,234,32
    ,89,166,76,189,158,224,0,240
    ,235,169,2369
45  220 DATA 3,44,169,8,133,255,
    177,47,145,45,200,196,255,20
    8,247,24,2156
10  230 DATA 165,45,101,255,133,
    45,165,46,105,0,133,46,160,0
    ,202,208,1809
54  240 DATA 229,24,165,47,101,2
    55,133,47,165,48,105,0,133,4
    8,76,0,1576
EC  250 DATA 1,185,0,239,153,0,2
    55,200,208,247,206,224,1,206
    ,227,1,2353
A1  260 DATA 173,227,1,201,223,2
    08,234,96,96,151,76,16,194,5
    0,249,120,2315
7D  270 DATA 169,14,141,247,7,16
    9,31,141,13,220,141,13,221,1
    73,13,220,1933
28  280 DATA 173,13,221,169,48,1
    41,20,3,169,192,141,21,3,173
    ,4,192,1683
E1  290 DATA 141,18,208,169,1,14
    1,26,208,88,96,169,14,141,32
    ,208,169,1829
F3  300 DATA 6,141,33,208,169,7,
    141,37,208,169,6,141,38,208,
    173,247,1932
B5  310 DATA 7,141,39,208,141,40
    ,208,141,41,208,169,0,141,21
    ,208,141,1854
23  320 DATA 0,208,169,29,141,1,
    208,169,175,141,248,7,169,16
    1,141,2,1969
F9  330 DATA 208,169,48,141,3,20
    8,169,182,141,249,7,169,152,
    141,4,208,2199
EF  340 DATA 169,228,141,5,208,1
    69,166,141,250,7,169,1,141,2
    1,208,169,2193
A7  350 DATA 3,141,28,208,169,19
    5,141,178,192,169,192,141,18
    3,192,76,241,2449
F9  360 DATA 192,231,234,96,74,1
    69,6,141,33,208,173,17,208,9
    ,8,141,1940
F6  370 DATA 17,208,173,4,192,14
    1,18,208,169,195,141,20,3,16
    9,192,141,1991
83  380 DATA 21,3,169,1,141,25,2
    08.76.49.234.173.247.7.141.3
    3,208,1736
31  390 DATA 165,250,201,4,48,34
    ,169,0,133,250,174,248,7,232
    ,224,180,2319
B6  400 DATA 48,19,224,182,48,9,
    162,176,173,0,208,201,160,24
    0,46,2,1898
F9  410 DATA 238,0,208,96,185,14
    2,248,7,230,250,169,1,141,25
    ,208,173,2321
D0  420 DATA 17,208,41,247,141,1
    7,208,169,151,141,20,3,169,1
    92,141,21,1886
02  430 DATA 3,173,3,192,141,18,
    208,104,168,104,170,104,64,1
    69,34,141,1796
90  440 DATA 178,192,169,193,141
    ,183,192,208,92,173,247,7,14
    1,33,208,165,2522
61  450 DATA 250,201,4,208,83,16
    9,0,133,250,174,248,7,202,22
    4,172,16,2341
75  460 DATA 47,162,172,169,1,14
    1,43,193,24,173,1,208,105,2,
    141,1,1583
0E  470 DATA 208,201,224,208,10,
    206,249,7,169,1,141,21,208,2
    08,41,201,2303
CB  480 DATA 244,144,37,169,5,14
    1,21,208,169,4,141,43,193,76
    ,132,193,1920
14  490 DATA 224,174,48,17,208,5
    ,238,249,7,208,10,169,3,141,
    21,208,1930
3E  500 DATA 169,46,141,1,208,76
    ,238,192,76,241,192,169,144,
    141,178,192,2404
81  510 DATA 169,193,141,183,192
    ,208,238,173,247,7,141,33,20
    8,165,250,201,2749
DD  520 DATA 4,208,20,169,0,133,
    250,173,250,7,201,171,240,12
    ,2,238,2078
A0  530 DATA 1,208,96,75,238,250
    ,7,76,241,192,174,248,7,224,
    159,208,2404
59  540 DATA 14,162,160,169,210,
    141,178,192,169,193,141,183,
    192,208,7,169,2488
AE  550 DATA 1,141,21,208,162,15
    9,76,238,192,173,247,7,141,3
    3,208,165,2172
59  560 DATA 250,201,4,208,35,16
    9,0,133,250,174,248,7,232,17
    3,0,208,2292
3B  570 DATA 208,3,76,4,194,224,
    164,48,12,224,166,48,2,162,1
    60,2,1697
23  580 DATA 206,0,208,96,64,76,
    238,192,76,241,192,169,48,14
    1,178,192,2317
58  590 DATA 169,192,141,183,192
    ,208,241,162,0,160,0,185,62,
    194,153,192,2434
F5  600 DATA 39,224,6,240,12,200
    ,208.243.232.238,22,194.238,
    25,194,208,2523
1A  610 DATA 232,192,63,240,3,20
    0,208,227,169,5,141,1,192,16
    9,192,141,2375
C6  620 DATA 2,192,76,5,192,170,
    33,1,162,39,1,64,0,13,64,0,1
    014
B0  630 DATA 15,162,33,23,162,33
    ,20,162,33,212,162,44,240,0,
    1,112,1414
2A  640 DATA 0,1,64,0,13,64,0,15
    ,162,33,23,162,33,20,162,33,
    785
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92   650 DATA 20,162,33,80,162,33
     ,208,162,33,64,162,33,6,128,
     51,0,1337
09   660 DATA 45,87,93,116,215,93
     ,117,87,93,117,23,93,117,6,1
     28,46,1476
FD   670 DATA 0,50,112,0,13,117,0
     ,95,125,208,215,93,212,87,13
     ,212,1552
86   680 DATA 16,0,212,112,128,40
     ,0,33,208,162,53,208,0,13,24
     7,0,1432
E0   690 DATA 13,119,0,95,7,64,21
     5,7,80,80,0,80,16,0,80,69,92
     5
D0   700 DATA 128,34,0,33,208,162
     ,33,208,162,36,208,0,13,221,
     2,0,1448
23   710 DATA 13,13,46,0,95,13,0,
     215,1,64,80,1,64,16,1,64,686
68   720 DATA 69,128,40,0,33,208,
     162,33,208,2,0,13,119,46,0,8
     7,1148
4A   730 DATA 7,64,215,7,80,80,0,
     80,16,0,80,22,128,46,0,50,87
     5
6D   740 DATA 112,0,13,117,0,95,1
     25,208,215,93,212,87,13,212,
     16,0,1518
61   750 DATA 212,69,128,48,0,33,
     6,162,45,6,0,192,3,1,192,9,1
     106
8A   760 DATA 129,160,0,195,0,69,
     128,42,0,33,24,162,51,24,0,4
     8,1065
2F   770 DATA 44,0,112,22,0,104,1
     5,128,208,0,192,192,0,195,0,
     72,1284
1C   780 DATA 128,39,0,52,96,0,48
     ,176,0,14,24,0,25,46,0,48,69
     6
E9   790 DATA 3,0,56,3,0,192,1,19
     3,162,35,195,0,13,128,39,0,1
     020
26   800 DATA 52,96,0,6,184,0,12,
     140,0,14,12,0,49,54,0,73,692
FD   810 DATA 35,0,192,0,66,164,3
     3,72,128,48,0,48,12,0,48,80,
     926
86   820 DATA 0,76,99,0,192,68,67
     ,129,128,0,65,125.128,51.0.3
     3,1161
4D   830 DATA 96,162,33,80,162,39
     ,72,1,128,148,0,72,125,163,3
     3,80,1394
FB   840 DATA 162,33,80,162,33,80
     ,162,33,240,162,33,240,162,3
     3,80,162,1857
7D   850 DATA 33,80,162,33,80,162
     ,33,240,162,33,240,162,33,80
     ,162,33,1728
71   860 DATA 80,162,33,80,162,33
     ,240,162,33,240,162,33,80,16
     2,33,80,1775
76   870 DATA 162,33,80,162,33,80
     ,162,33,96,163,33,4,162,33,2
     0,162,1418
2F   880 DATA 53,23,64,0,23,64,0,
     3,116,0,3,119,64,0,55,84,671
9A   890 DATA 0,55,92,0,3,84,162,
     33,16,128,34,0,50,4,0,20,681
26   900 DATA 20,0,28,23,67,84,23
     ,67,208,3,117,192,3,125,192,
     2,1154
E5   910 DATA 0,28,0,128,40,0,44,
     29,117,213,93,117,215,93,117
     ,213,1447
7E   920 DATA 93,117,212,128,51,0
     ,33,69,128,51,0,45,29,117,21
     3,93,1379
2B   930 DATA 117,215,93,117,213,
     93,117,212,69,128,46,0,33,13
     ,162,47,1675
E2   940 DATA 93,112,7,125,245,23
     ,117,215,23,112,213,23,0,4,1
     3,128,1453
5C   950 DATA 40,0,33,7,162,33,7,
     162,50,223,112,0,221,112,1,2
     08,1371
0F   960 DATA 245,5,208,215,5,0,5
     ,5,0,4,69,128,34,0,33,7,963
08   970 DATA 162,33,7,162,33,7,1
     62,33,119,3,112,0,112,43,245
     ,1,1234
AE   980 DATA 64,215,1,64,5,1,64,
     4,69,128,40,0,33,7,162,33,89
     0
82   990 DATA 7,162,50,221,112,0,
     221,112,1,208,213,5,208,215,
     5,0,1740
02   1000 DATA 5,5,0,4,22,128,46,
     0,33,13,162,47,93,112,7,125,
     802
19   1010 DATA 245,23,117,215,23,
     112,213,23,0,4,0,194,33,250,
     194,33,1679
F3   1020 DATA 250,162,33,42,162,
     33,40,162,33,168,162,44,160,
     0,2,160,1613
28   1030 DATA 0,2,128,0,10,128,0
     ,10,162,33,42,162,33,40,162,
     33,945
15   1040 DATA 168,162,39,160,0,2
     ,160,0,2,128,162,33,128,174,
     194,33,1545
B2   1050 DATA 250,194,33,250,162
     ,33,10,162,33,10,162,33,10,1
     62,33,10,1547
31   1060 DATA 162,33,10,162,33,1
     0,162,33,10,162,33,10,162,33
     ,10,162,1187
7D   1070 DATA 33,10,162,33,10,16
     2,33,10,162,33,10,162,33,10,
     162,33,1058
23   1080 DATA 10,162,33,10,162,3
     3,10,162,33,10,162,34,10,0,0
     ,0,831
10   1090 DATA 169,0,133,250,169,
     152,133,251,169,1,133,174,13
     3,193,169,8,2237
61   1100 DATA 133,175,133,194,16
     9,128,133,252,169,158,133,25
     3,160,0,177,250,2617
55   1110 DATA 145,174,230,250,20
     8,2,230,251,230,174,208,2,23
     0,175,165,250,2924
86   1120 DATA 197,252,208,234,16
     5,251,197,253,208,228,76,26,
     8,169,6,141,2619
17   1130 DATA 33,208,169,0,133,1
     93,169,192,133,194,169,126,1
     33,174,169,200,2395
B3   1140 DATA 133,175,169,51,133
     ,187,169,159,133,188,169,14,
     133,183,169,0,2165
09   1150 DATA 133,185,160,0,185,
     3,159,240,6,32,210,255,200,2
     08,245,32,2253
BB   1160 DATA 207,255,240,251,20
     1,49,240,4,201,56,48,230,41,
     15,133,186,2357
FF   1170 DATA 76,234,245,147,17,
     17,73,78,80,85,84,32,68,69,8
     6,73,1464
5F   1180 DATA 67,69,32,78,85,77,
     66,69,82,13,17,67,65,83,61,4
     9,980
E3   1190 DATA 32,47,32,68,73,83,
     75,61,32,56,32,79,82,32,57,5
     8,899
2C   1200 DATA 45,32,0,66,79,82,6
     8,69,82,32,83,80,82,73,84,69
     ,1026
20   1210 DATA 83,0,0,255,255,255
     ,0,0,0,0,0,0,0,0,0,0,848
```

PROGRAM: SPRITELY BORDERS DISASSEMBLY

```
 10 0000                        ;*********************
 20 0000                        ;SPRITES IN THE BORDER
 30 0000                        ;*********************
 40 0000      SPRITOX           =$D000          ;SPRITE 0 X-POSITION
 50 0000      SPRITOY           =$D001          ;SPRITE 0 Y-POSITION
 60 0000      SPRITCH           =$D015          ;SPRITE ON/OFF SWITCH
 70 0000      COUNTER           =$FA            ;INTERRUPT COUNTDOWN
 80 0000      RASTERLO          =$D012          ;RASTER POSITION LO-BYTE
 90 0000      RASTERHI          =RASTERLO-1     ;RASTER POSITION HI-BYTE
100 0000      INTLO             =$0314          ;LO-BYTE INTERRUPT VECTOR
110 0000      INTHI             =INTLO+1        ;HI-BYTE INTERRUPT VECTOR
120 0000      SPRITE0           =$07F8          ;SPRITE 0 SHAPE
130 0000      COLOUR            =$07F7          ;SCREEN COLOUR
140 0000      FALSEBORDER       =$D021          ;SCREEN COLOUR LOCATION
150 0000      STORE             =$27C0          ;SPRITE TEMPLATES
160 C000                        .ORG    $C000
170 C000 4C10C2                 JMP SETUP       ;MOVE SPRITE TEMPLATE
180 C003 32   RASTOP            .BYTE   $32     ;INTERRUPT TIMER POSITIONS
190 C004 F9   RASBOT            .BYTE   $F9
```

```
200 C005                          ;INTERRUPT SETUP
210 C005 78       START           SEI                  ;INTERRUPT SETUP
220 C006 A90E                     LDA #$0E
230 C008 8DF707                   STA COLOUR
240 C00B A91F                     LDA #$1F
250 C00D 8D0DDC                   STA $DC0D
260 C010 8D0DDD                   STA $DD0D
270 C013 AD0DDC                   LDA $DC0D
280 C016 AD0DDD                   LDA $DD0D
290 C019 A930                     LDA #REPEATER&255
300 C01B 8D1403                   STA INTLO
310 C01E A9C0                     LDA #REPEATER/256
320 C020 8D1503                   STA INTHI
330 C023 AD04C0                   LDA RASBOT
340 C026 8D12D0                   STA RASTERLO
350 C029 A901                     LDA #$01
360 C02B 8D1AD0                   STA $D01A
370 C02E 58                       CLI
380 C02F 60                       RTS
390 C030                          ;
400 C030 A90E     REPEATER        LDA #$0E
410 C032 8D20D0                   STA $D020            ;BORDER LT. BLUE
420 C035 A906                     LDA #$06
430 C037 8D21D0                   STA FALSEBORDER      ;SCREEN DK.BLUE
440 C03A A907                     LDA #$07
450 C03C 8D25D0                   STA $D025            ;MULTICOL YELLOW
460 C03F A906                     LDA #$06
470 C041 8D26D0                   STA $D026            ;MULTICOL DK.BLUE
480 C044 ADF707                   LDA COLOUR           ;LT.BLUE
490 C047 8D27D0                   STA $D027            ;SPRITE 0 COL
500 C04A 8D28D0                   STA $D028            ;SPRITE 1 COL
510 C04D 8D29D0                   STA $D029            ;SPRITE 2 COL
520 C050 A900                     LDA #$00             ;SWITCH SPRITES OFF
530 C052 8D15D0                   STA SPRITCH
540 C055 8D00D0                   STA SPRITOX          ;SET CATERPILLAR POSITION
550 C058 A91D                     LDA #$1D
560 C05A 8D01D0                   STA SPRITOY
570 C05D A9AF                     LDA #$AF             ;SET SPRITE 0 SHAPE
580 C05F 8DF807                   STA SPRITE0
590 C062 A9A1                     LDA #$A1             ;SET TRAPDOOR POSITION
600 C064 8D02D0                   STA $D002
610 C067 A930                     LDA #$30
620 C069 8D03D0                   STA $D003
630 C06C A9B6                     LDA #$B6             ;SET TRAPDOOR SHAPE
640 C06E 8DF907                   STA SPRITE0+1
650 C071 A998                     LDA #$98             ;SET WATER SPRITE POSITION
660 C073 8D04D0                   STA $D004
670 C076 A9E4                     LDA #$E4
680 C078 8D05D0                   STA $D005
690 C07B A9A6                     LDA #$A6             ;SET WATER SPRITE SHAPE
700 C07D 8DFA07                   STA SPRITE0+2
710 C080 A901                     LDA #$01
720 C082 8D15D0                   STA SPRITCH          ;SWITCH SPRITE 0 ON
730 C085 A903                     LDA #$03
740 C087 8D1CD0                   STA $D01C            ;SPRITE 0 & 1 = MULTICOL
750 C08A A9C3                     LDA #SPLIT2&255      ;SET SPLIT2 INTERRUPT
760 C08C 8DB2C0                   STA SET2LO+1         ;VECTORS IN SPLIT1
770 C08F A9C0                     LDA #SPLIT2/256
780 C091 8DB7C0                   STA SET2HI+1
790 C094 4CF1C0                   JMP LEAVIT
800 C097                          ;
810 C097                          ;
820 C097                          ;
830 C097 EA       SPLIT1          NOP
840 C098 EA                       NOP
```

```
C099 EA                   NOP
C09A EA                   NOP
C09B EA                   NOP
C09C EA                   NOP
C09D EA                   NOP
C09E A906                 LDA #$06          ;SERVICE SCREEN
C0A0 8D21D0               STA FALSEBORDER   ;SCREEN DK.BLUE
C0A3 AD11D0               LDA RASTERHI      ;:SET RASTER INTERRUPT POSI
TION
C0A6 0908                 ORA #$08
C0A8 8D11D0               STA RASTERHI
C0AB AD04C0               LDA RASBOT
C0AE 8D12D0               STA RASTERLO
C0B1 A9C3    SET2LO       LDA #SPLIT2&255   ;SET VECTORS TO
C0B3 8D1403               STA INTLO         ;NEXT SPLIT
C0B6 A9C0    SET2HI       LDA #SPLIT2/256
C0B8 8D1503               STA INTHI
C0BB A901                 LDA #$01
C0BD 8D19D0               STA $D019
C0C0 4C31EA               JMP $EA31
C0C3                      ;**********************
C0C3                      ;MOVE CATERPILLAR RIGHT
C0C3                      ;**********************
C0C3 ADF707  SPLIT2       LDA COLOUR        ;SET SCREEN COLOUR
C0C6 8D21D0               STA FALSEBORDER   ;TO BORDER COLOUR
C0C9 A5FA                 LDA COUNTER       ;INTERRUPT SELECTION
C0CB C904                 CMP #$04
C0CD 3022                 BMI LEAVIT        ;NOT CORRECT INTERRUPT
C0CF                      ;
C0CF A900                 LDA #$00
C0D1 85FA                 STA COUNTER       ;RESET COUNTER
C0D3 AEF807               LDX SPRITE0
C0D6 E8                   INX               ;CHANGE SPRITE
C0D7 E0B4                 CPX #$B4          ;TIME TO MOVE?
C0D9 3013                 BMI STORIT
C0DB E0B6                 CPX #$B6          ;END OF ANIMATION CYCLE?
C0DD 3009                 BMI OKAY
C0DF A2B0                 LDX #$B0          ;FIRST SPRITE IN CYCLE
C0E1 AD00D0               LDA SPRITOX
C0E4 C9A0                 CMP #$A0          ;REACHED FINAL SCREEN POSIT
ION?
C0E6 F02E                 BEQ SPLINT3       ;YES - SET UP NEXT SPLIT
C0E8 EE00D0  OKAY         INC SPRITOX       ;MOVE SPRITE
C0EB EE00D0               INC SPRITOX
C0EE 8EF807  STORIT       STX SPRITE0       ;CHANGE SPRITE
C0F1 E6FA    LEAVIT       INC COUNTER       ;EXIT INTERRUPT
C0F3 A901                 LDA #$01
C0F5 8D19D0               STA $D019
C0F8 AD11D0               LDA RASTERHI
C0FB 29F7                 AND #$F7
C0FD 8D11D0               STA RASTERHI
C100 A997                 LDA #SPLIT1&255
C102 8D1403               STA INTLO
C105 A9C0                 LDA #SPLIT1/256
C107 8D1503               STA INTHI
C10A AD03C0               LDA RASTOP
C10D 8D12D0               STA RASTERLO
C110 68                   PLA
C111 A8                   TAY
C112 68                   PLA
C113 AA                   TAX
C114 68                   PLA
C115 40                   RTI
C116                      ;****************
C116                      ;SET UP NEXT SPLIT
C116                      ;****************
```

```
 1490 C116 A922   SPLINT3          LDA #SPLIT3&255
 1500 C118 8DB2C0                  STA SET2LO+1
 1510 C11B A9C1                    LDA #SPLIT3/256
 1520 C11D 8DB7C0                  STA SET2HI+1
 1530 C120 D05C                    BNE MARKOUT
 1540 C122                         ;**********************
 1550 C122                         ;OPEN TRAPDOOR AND FALL
 1560 C122                         ;**********************
 1570 C122 ADF707 SPLIT3           LDA COLOUR          ;IMITATE BORDER
 1580 C125 8D21D0                  STA FALSEBORDER
 1590 C128 A5FA                    LDA COUNTER         ;INTERRUPT TIME?
 1600 C12A C904   COUNTDOWN        CMP #$04
 1610 C12C D053                    BNE NOTTIME
 1620 C12E A900                    LDA #$00
 1630 C130 85FA                    STA COUNTER
 1640 C132 AEF807                  LDX SPRITE0
 1650 C135 CA                      DEX                 ;BEND SPRITE 0
 1660 C136 E0AC                    CPX #$AC            ;DONE BENDING?
 1670 C138 102F                    BPL BEND2
 1680 C13A A2AC                    LDX #$AC
 1690 C13C A901                    LDA #$01            ;INTERRUPT MORE OFTEN
 1700 C13E 8D2BC1                  STA COUNTDOWN+1
 1710 C141 18                      CLC
 1720 C142 AD01D0                  LDA SPRITOY         ;SPRITE FALL
 1730 C145 6902                    ADC #$02
 1740 C147 8D01D0                  STA SPRITOY
 1750 C14A C9E0                    CMP #$E0
 1760 C14C D00A                    BNE DONTSHUT
 1770 C14E CEF907                  DEC SPRITE0+1
 1780 C151 A901                    LDA #$01
 1790 C153 8D15D0                  STA SPRITCH
 1800 C156 D029                    BNE NOTTIME
 1810 C158 C9F4   DONTSHUT         CMP #$F4            ;BOTTOM OF FALL?
 1820 C15A 9025                    BCC NOTTIME
 1830 C15C A905                    LDA #$05            ;TURN OFF TRAPDOOR
 1840 C15E 8D15D0                  STA SPRITCH         ;TURN ON WATER SPLASH
 1850 C161 A904                    LDA #$04
 1860 C163 8D2BC1                  STA COUNTDOWN+1
 1870 C166 4C84C1                  JMP SPLINT4         ;SET UP BIGGER SPLASH INTER
RUPT
 1880 C169 E0AE   BEND2            CPX #$AE
 1890 C16B 3011                    BMI MARKOUT
 1900 C16D D005                    BNE BEND1
 1910 C16F EEF907                  INC SPRITE0+1       ;FULL OPEN DOOR
 1920 C172 D00A                    BNE MARKOUT
 1930 C174 A903   BEND1            LDA #$03            ;SWITCH TRAPDOOR ON
 1940 C176 8D15D0                  STA SPRITCH         ;HALF OPEN DOOR
 1950 C179 A92E                    LDA #$2E
 1960 C17B 8D01D0                  STA SPRITOY
 1970 C17E 4CEEC0 MARKOUT          JMP STORIT
 1980 C181 4CF1C0 NOTTIME          JMP LEAVIT
 1990 C184                         ;*******************
 2000 C184                         ;SET UP SPLIT VECTORS
 2010 C184                         ;*******************
 2020 C184 A990   SPLINT4          LDA #SPLIT4&255
 2030 C186 8DB2C0                  STA SET2LO+1
 2040 C189 A9C1                    LDA #SPLIT4/256
 2050 C18B 8DB7C0                  STA SET2HI+1
 2060 C18E D0EE                    BNE MARKOUT
 2070 C190                         ;*********************************************
*
 2080 C190                         ;SPLASH SPREADS & CATERPILLAR MOVES HORIZONTA
L
 2090 C190                         ;*********************************************
*
```

```
 2100 C190 ADF707 SPLIT4          LDA COLOUR
 2110 C193 8D21D0                 STA FALSEBORDER
 2120 C196 A5FA                   LDA COUNTER        ;:INTERRUPT TIME?
 2130 C198 C904                   CMP #$04
 2140 C19A D014                   BNE NOTNOW
 2150 C19C A900                   LDA #$00
 2160 C19E 85FA                   STA COUNTER
 2170 C1A0 ADFA07                 LDA SPRITE0+2
 2180 C1A3 C9AB                   CMP #$AB           ;SPLASH DONE?
 2190 C1A5 F00C                   BEQ SPLASHOFF
 2200 C1A7 EE01D0                 INC SPRITOY        ;MOVE SPRITE 0 DOWN
 2210 C1AA EE01D0                 INC SPRITOY
 2220 C1AD EEFA07                 INC SPRITE0+2
 2230 C1B0 4CF1C0 NOTNOW          JMP LEAVIT
 2240 C1B3 AEF807 SPLASHOFF       LDX SPRITE0        ;MOVE SPRITE 0 TO HORIZONTA
L
 2250 C1B6 E09F                   CPX #$9F
 2260 C1B8 D00E                   BNE NOTFLAT
 2270 C1BA A2A0                   LDX #$A0
 2280 C1BC A9D2                   LDA #SPLIT5&255    ;SET UP NEXT SPLIT
 2290 C1BE 8DB2C0                 STA SET2LO+1
 2300 C1C1 A9C1                   LDA #SPLIT5/256
 2310 C1C3 8DB7C0                 STA SET2HI+1
 2320 C1C6 D007                   BNE GOTO
 2330 C1C8 A901   NOTFLAT         LDA #$01           ;ONLY CATERPILLAR SPRITE ON
 2340 C1CA 8D15D0                 STA SPRITCH
 2350 C1CD A29F                   LDX #$9F
 2360 C1CF 4CEEC0 GOTO            JMP STORIT
 2370 C1D2                        ;********************
 2380 C1D2                        ;MOVE CATERPILLAR LEFT
 2390 C1D2                        ;********************
 2400 C1D2 ADF707 SPLIT5          LDA COLOUR
 2410 C1D5 8D21D0                 STA FALSEBORDER
 2420 C1D8 A5FA                   LDA COUNTER        ;INTERRUPT TIME?
 2430 C1DA C904                   CMP #$04
 2440 C1DC D023                   BNE DONT
 2450 C1DE A900                   LDA #$00
 2460 C1E0 85FA                   STA COUNTER
 2470 C1E2 AEF807                 LDX SPRITE0
 2480 C1E5 E8     WRIGGLE         INX                ;CHANGE SPRITE SHAPE
 2490 C1E6 AD00D0                 LDA SPRITOX        ;OFF THE SCREEN?
 2500 C1E9 D003                   BNE NOREPEAT
 2510 C1EB 4C04C2                 JMP REPEAT         ;RESET ALL VECTORS
 2520 C1EE E0A4   NOREPEAT        CPX #$A4           ;TIME TO MOVE SPRITE?
 2530 C1F0 300C                   BMI DOSPRITE
 2540 C1F2 E0A6                   CPX #$A6           ;FINAL ANIMATION FRAME?
 2550 C1F4 3002                   BMI ALRIGHT
 2560 C1F6 A2A0                   LDX #$A0           ;RESET TO FIRST ANIMATION F
RAME
 2570 C1F8 CE00D0 ALRIGHT         DEC SPRITOX        ;MOVE SPRITE LEFT
 2580 C1FB CE00D0                 DEC SPRITOX
 2590 C1FE 4CEEC0 DOSPRITE        JMP STORIT
 2600 C201 4CF1C0 DONT            JMP LEAVIT
 2610 C204                        ;*********************************
 2620 C204                        ;SET SPLIT VECTORS FOR RESET ROUTINE
 2630 C204                        ;*********************************
 2640 C204 A930   REPEAT          LDA #REPEATER&255
 2650 C206 8DB2C0                 STA SET2LO+1
 2660 C209 A9C0                   LDA #REPEATER/256
 2670 C20B 8DB7C0                 STA SET2HI+1
 2680 C20E D0F1                   BNE DONT
 2690 C210                        ;*********************************
 2700 C210                        ;MOVE SPRITE TEMPLATE INTO POSITION
 2710 C210                        ;*********************************
```

```
2720 C210 A200    SETUP     LDX #$00
2730 C212 A000    LOOPA     LDY #$00
2740 C214 B93EC2  LOOPB     LDA SPRITES,Y
2750 C217 99C027            STA STORE,Y
2760 C21A E006              CPX #$06
2770 C21C F00C              BEQ CHECK
2780 C21E C8                INY
2790 C21F D0F3              BNE LOOPB
2800 C221 E8                INX
2810 C222 EE16C2            INC LOOPB+2
2820 C225 EE19C2            INC LOOPB+5
2830 C228 D0E8              BNE LOOPA
2840 C22A C03F    CHECK     CPY #$3F
2850 C22C F003              BEQ DONE
2860 C22E C8                INY
2870 C22F D0E3              BNE LOOPB
2880 C231 A905    DONE      LDA #$05
2890 C233 8D01C0            STA $C001
2900 C236 A9C0              LDA #$C0
2910 C238 8D02C0            STA $C002
2920 C23B 4C05C0            JMP START
2930 C23E         SPRITES
```

Routine Programming

PROGRAM: SUBROUTINE LOADER

```
02  0 PRINT"[CLR,DOWN] [RVSON]R[RVSOFF]UN PROGRAM OR [RVSON]L[RVSOFF]OAD SUBROUTINE?"
91  1 GETA$:IFA$<>"R"ANDA$<>"L"ANDA$<>"[SR]"AND A$<>"[SL]"THEN1
8D  2 FORA=0TO15:POKE56256+A,6:NEXT:IF A$="R"OR A$="[SR]" THEN 9
E0  3 INPUT"SUBROUTINE FILENAME";N$:L=LEN(N$):IFN$=CHR$(13)ORL=0THENEND
23  4 FORA=1TOL:POKE1983+A,ASC(MID$(N$,A,1)):NEXT:POKE186,8:REM POKE186,1 FOR TAPE
5F  5 POKE183,L:POKE184,1:POKE185,0:IFPEEK(186)=1ANDN$="*"THENPOKE183,0
BA  6 POKE187,192:POKE188,7:POKE195,PEEK(45)-2:POKE196,PEEK(46):POKE147,0:SYS62631
53  7 IFST=64ORST=0THENSYS42291:POKE45,PEEK(174):POKE46,PEEK(175)
88  8 END
36  9 CLR:PRINT"[CLR]";
```

Sprite Library

In this month's delve into the library, Mike Benn discovers bird flight

This month we go in search of that rare and exotic bird, the sprite. There are six sequences which can be joined together to make up longer sequences: the bird is made up of a single sprite, so it's possible to have a flock of birds flying around the screen at one time.

Table (Bird Flight - Multicolour)

A0-A4/160-164 Bird perched facing right, takes off to fly
A4-B3/164-179 Bird in flight, facing right
B3-B8/179-184 Bird turning to face viewer
B8-C7/184-199 Bird flying, facing viewer
C8-D1/200-209 Bird landing, facing viewer
D2-DF/210-223 Bird approaching from distance and turning to the right

Getting it all in

Type in the basic loader as published, and remember – save it, don't run it, or it will self-destruct and, possibly, burst into flames. Before running the loader program, you'll need to reset the computer and type in directly the following:-

POKE43,0:POKE44,64:POKE16384,0:NEW and press return.

This will trick the computer into believing that the basic now starts at $4000 instead of $0801. Load in the basic loader and run it; if error free, the program will automatically save itself as a block of data. If you reload that data in the future, remember to add a 1 after the device number. The data is saved in the following location: $2800-$37FF.

The sprites run from 160 to 223 in a compromise to avoid the area $2000 traditionally set aside for redefined character graphics, and to avoid the need of typing in line after line of data.

If only one or two sprites are required, then use this formula – (Sprite block No.-160) *40 + 190 = the data line number at which that sprite block's data starts. Remember to type in the following three lines of data and alter the variable BL to the number of data lines you have in your finished program, less one.

The small basic program BIRD FLT DISPLAY will variously animate the sprites in both non-expanded and expanded forms on the screen simultaneously. To hold on any sprite, enter the same number for Start and End.

Any Sprite Editor program will enable you to change and adapt the individual sprites to your own requirements.

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B R E A K

Readers Problems

Though the Commodore 64 is one of the world's most popular microcomputers, it can be very difficult to find speecific information about your particular machine.

At the *Your Commodore* office we receive literally hundreds of letters from you, our readers, on a wide range of subjects ranging from the simple 'Can you give me the telephone number for ...', to the more complex 'I'm trying to write a program that uses a split screen. How do I do it?'

Unfortunately, the volume of mail received has become so great that it is impossible to answer every letter and still mange to publish a magazine each month.

For this reason we have felt it necessary to produce a number of guidelines for getting information from us.

1) We cannot guarantee to answer every letter sent to the magazine. Should it become apparent that a number of readers are suffering from the same problem, then we will reply to the letter via the Letters page.

2) A new helpline has been set up. This will be open for your queries on Tuesday and Thursday afternoons between 2.00pm and 4.00pm. We will not be able to deal with your telephone queries at any other time. If our technical adviser is not available when you ring, then a message will be taken

3) If you are having problems with one of our listings, can you please let us know in writing. This will enable us to see if a number of people are having the same problem. When a common problem becomes apparent with a program, then a correction sheet will be issued. Enclose a self-addressed, stamped envelope and we will send you a copy of the correction sheet as soon as it is available.

We are sorry that it has become necessary to instigate these rules. However, we are sure that you will agree with us that the more time that we can spend making *Your Commodore* the most informative magazine around, the better.

For program queries write to:
Program Corrections
Your Commodore
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W1R 3AB
If you wish to telephone then call:
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Commodore Where Are You?

At the *Your Commodore* office we are repeatedly asked for the address and telephone number of Commodore U.K. Many people, after referring to their computer manuals, believe them to be based in Corby.

The Commodore plant at Corby was closed down some time ago. Reproduced here you will find the correct address for Commodore U.K.

We suggest that you write this correct address in the front of your computers manual for future reference.

Commodore Business Machine, (UK),
Commodore House,
The Switchback,
Gardner Road,
Maidenhead,
Berks SL6 7XA.

SPRITE CONTROLLER

The listing for the sprite controller has somehow got slightly mixed up. Line 21728 should read:- DATA 64, 114,64,114,64,114,64,110. The line 22216 should read DATA 32, 32,32,32,32,32,32,32 The rest of the listing is correct, although the lines are out of sequence. This should not present any problems though.

GTX COMPILER

The more eagle eyed amongst you will have noticed that the gremlins have been at it again. This time there were two listings missing from the GTX Compiler program. If you would like copies of these listings, then send a large SAE to us at Bug finders and we will send them by return.

Bug Finder

We'd like to remind our readers that we run a Bug Finder service.

If you have typed in one of our programs and despite much checking, you still can't get it to run, then send us the following:

Two copies of your program on tape or disk.

A description of your problem.

If possible a listing of your work (you may omit this).

A stamped, self-addressed envelope for return of the program to you.

Should any of the above be missing then we will not be able to deal with your query.

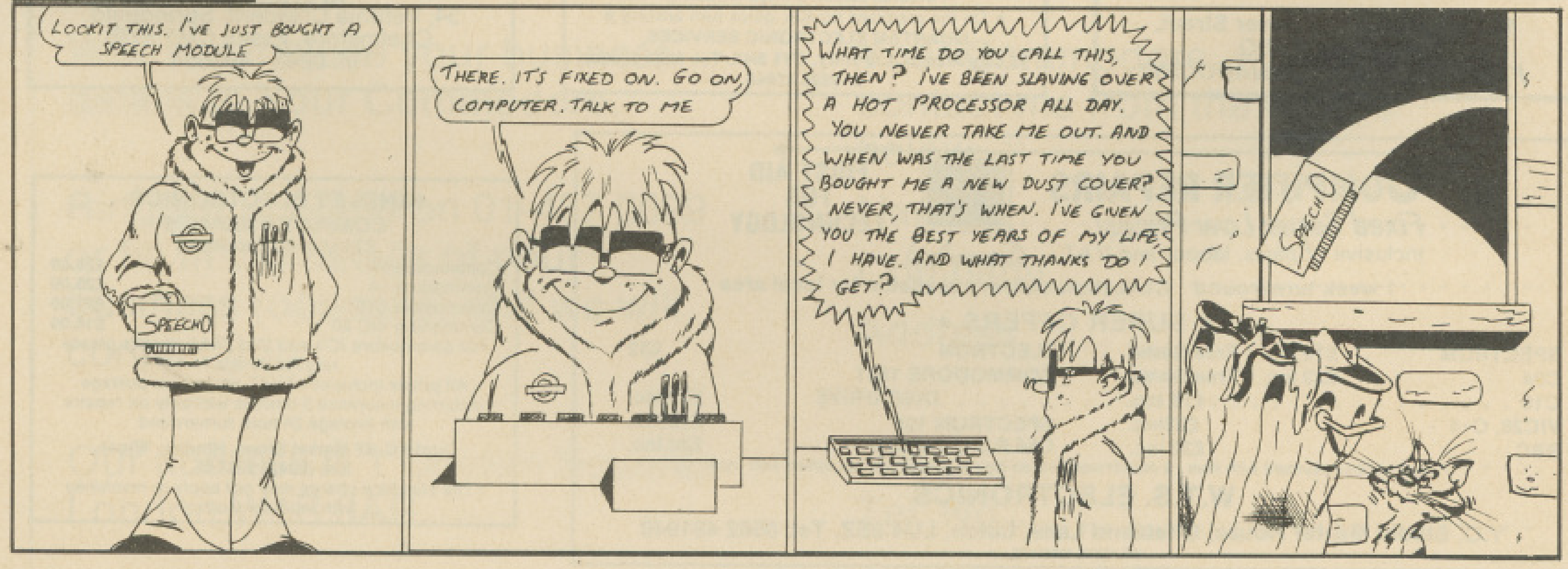
We will try to point out where you have made errors and place a corrected copy of the program back on to your tape or disk before we return it to you.

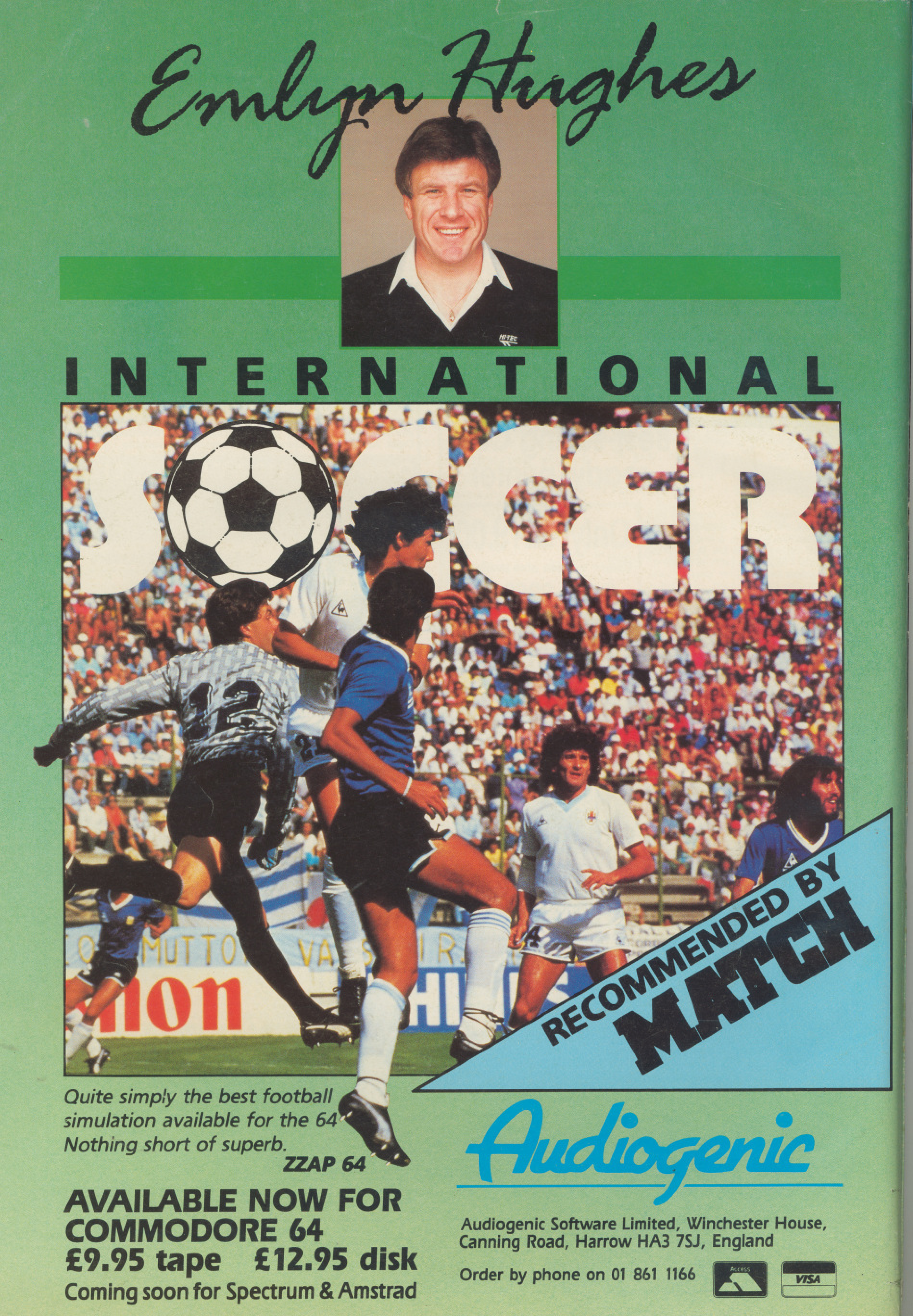
Do not send a program to us as soon as it stops working, please check it several times first.

We do get a large number of queries and so it may take a while for us to deal with yours personally.

Note: we can only deal with problems relating to programs published in *Your Commodore*.

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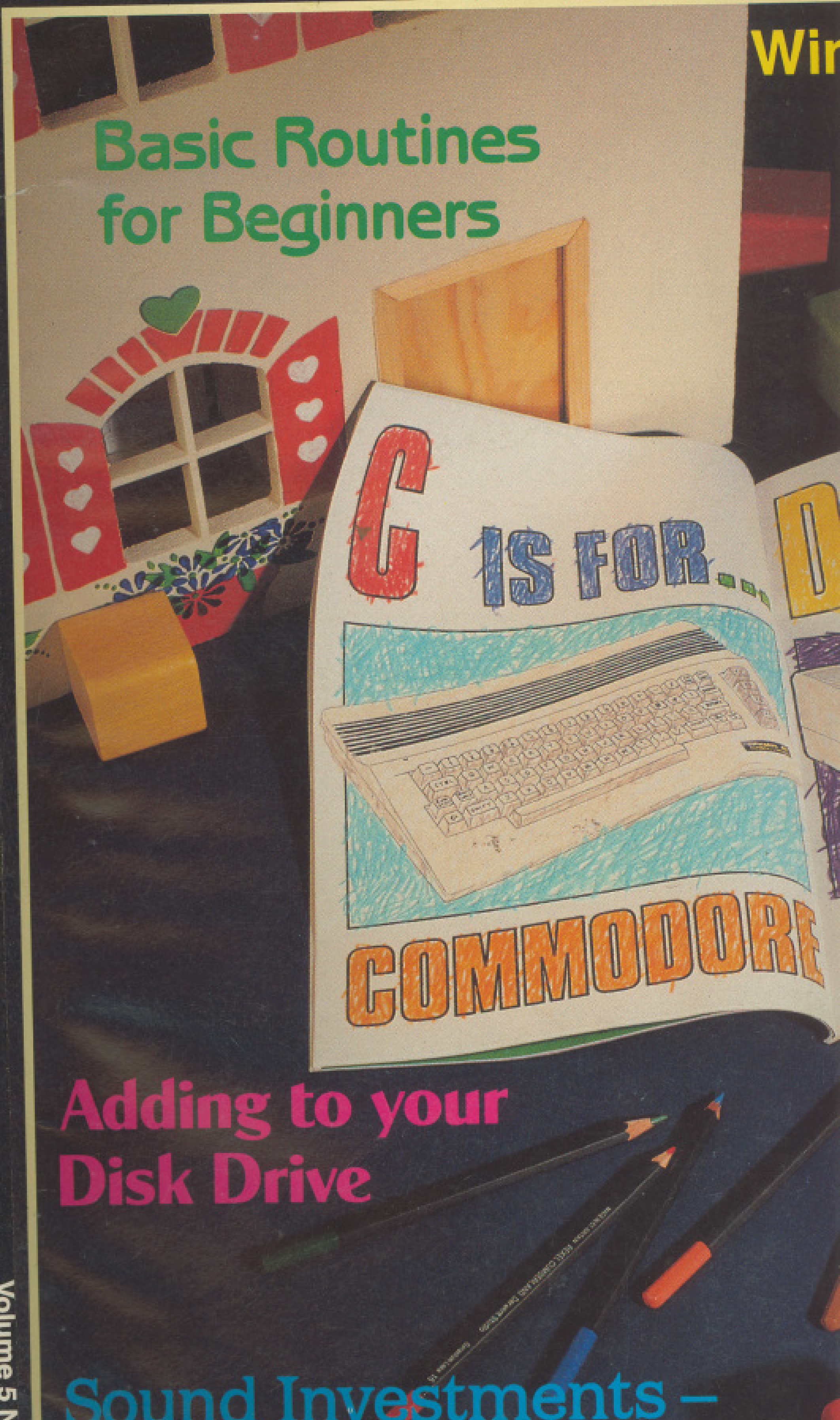
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